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1957 Annual Report

SECRETARY OF THE

Interior

FRED A. SEATON

For the Fiscal Year Ended June 30, 1957

March 3, 1849

Developing America's Resource Base

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March 3, 1849

THE SECRETARY OF THE INTERIOR
WASHINGTON

My Dear Mr. President: Transmitted herewith is the annual report of the Department of the Interior for the fiscal year which ended June 30, 1957.

The activities of the Department's bureaus and offices, as summarized in this report, indicate the measure of continuing progress which is being made in the conservation and development of the Nation's natural resources. We feel that the accomplishments of the past year give ample proof that the goals of intelligent conservation and orderly development of natural resources are thoroughly compatible.

While the report indicates that substantial progress is being made, many natural resource problems demand our fullest attention. We shall continue to work earnestly and creatively to insure that the resource requirements of today and tomorrow are fully and efficiently met.

Sincerely yours,

Fred A. Seaton
Secretary of the Interior.

The President,
The White House,
Washington, D. C.

United States
Department of the Interior

Fred A. Seaton, *Secretary*

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PART I

DEVELOPING AMERICA'S RESOURCE BASE

Developing America's Resource Base

THE DYNAMIC ECONOMIC STRENGTH of modern-day America depends upon the full and creative development of our country's natural resource base—our mineral wealth, our vast plains, our timber-laden forests, and our flowing rivers and streams. In peace and war, these resources have met the needs of our Nation and have provided the sinews for the most highly developed industrial machine the world has known.

Our resources, however, are far from inexhaustible, and as our national output rises, corresponding depletions are made in the storehouse of nature's bounty.

Predictions are being made, in fact, that by the middle of the 21st century, the world's population will have increased 4 or 5 times. In this world of tomorrow, the predictions continue, people will face a grim struggle for existence, with their food and water in short supply and their reserves of many minerals exhausted.

No one really knows, of course, whether such predictions will ever come true. Human resourcefulness, ingenuity and invention should be able to prevent such a calamity. Our Nation, however, must work creatively to provide for the realistic development of its natural resource base in order to meet the growing demands of today's citizens and to pass along our resource heritage to generations of unborn Americans.

This is the task of the Department of the Interior, which has centered its activities on helping meet constructively both the immediate and long-range requirements of our expanding economy. Although directed toward harnessing natural resources for the peaceful pursuits of our people, the contribution of the Department's efforts to our national security in a troubled world cannot be overestimated.

Demands of the Future

Our economy is changing while it expands at an accelerating pace. Science and technology, together with a rising standard of living, are creating new demands for goods and services which were unknown just a decade ago. As a result, the total drain on our natural resources will continue to increase in the years ahead.

In 1975, our population will need about 450 billion gallons of water per day—about twice as much as is consumed today. Electric power capacity will have to be increased from 123 million kilowatts in 1956 to 321 million kilowatts by 1975.

This task of developing our natural resources to meet future requirements is gigantic, and the possibilities of irretrievable losses are ever present in man's effort to utilize nature's gifts.

Moreover, major decisions relating to the development of our natural resources have implications for the distant future. For example, investments in a multipurpose dam may yield returns over many decades. Likewise, the failure to initiate a watershed or fishery-protection program may place a region at a permanent disadvantage. Sound planning is essential if we are to derive full benefit from our natural resources. The alternative is waste, inefficiency, and shortages.

Resource Problems Are Complex

Resource development projects have become larger and more complex in recent years. For example, construction and operation of a multiple-purpose dam may involve decisions on the use of water for irrigation, for industrial and household use, for electric power, for commercial and sports fisheries, and for boating, swimming, and hunting.

These decisions concerning the competing uses for water cannot, and should not, be made by the Department of the Interior or the Federal Government alone. They require the closest cooperation among all groups and individuals, both private and public, if we are to achieve the maximum development and optimum use of this most vital natural resource.

Similar problems arise from the competing demands for the use of public land resources. While in many instances it is possible to provide for multiple uses of the same land, certain cases may arise in which the proposed uses are in such sharp conflict that a specific choice must be made.

Increased Costs a Factor

The most serious problems facing our natural resources industries arise, paradoxically, as a result of the high level of economic activity which we have been enjoying. The unprecedented output of our farms, factories, and mines is causing tremendous drains on some of our basic resources.

Some of the conventional sources of electric power are becoming less abundant and more costly, and most of the nation's low-cost hydroelectric power sites have been developed. The Federal Power Commission has estimated that in the next 20 years, falling water can provide only 8½ percent of our new electric generating capacity, except at a substantially higher cost. We must continue our unremitting search for new sources of low-cost energy if we are to meet our growing needs.

Our increasing consumption of minerals is causing heavy depletion of our highest grade low-cost ores. Unless we can find ways of using economically our low-grade ores and making greater use of those minerals which are still abundant, we will encounter sharply rising costs for our minerals and fuels.

The economic forces which are exerting an upward pressure on the costs of producing electric power and minerals are also making themselves felt in the development and use of our water resources. If we do not conserve and use our water supply more effectively, some regions of our country face the prospect of paying an excessively high price for water.

Recreational Values

While many activities of the Department of the Interior deal with material things, we know that achievement of the good life for all citizens involves more than goods and services. There are countless opportunities for growth and fulfillment which are offered by our great outdoor recreational areas, our historic shrines, and our fish and wildlife resources.

Our rapid economic growth is having a profound impact not only on our energy, water, and mineral resources but also on our scenic, wilderness, and historic areas, as well as on our fish and wildlife habitats. With rising incomes, more spare time, and better transportation, increasing millions of people are visiting our national parks, other recreational areas, and hunting and fishing grounds.

To accommodate this rapidly growing throng of American families seeking pleasure in their country's vast outdoors, the facilities of our National Park Service must be improved and increased impetus must be placed on the development of our fish and wildlife resources.

The sections of this report which follow describe the programs of the Department of the Interior for the development of our Nation's natural resource base to meet those challenges of the future which have been briefly described in the preceding pages.

DEVELOPMENT OF MINERALS AND FUELS

An expanding minerals resource base continues to be essential to the military security and economic health of our Nation, both today and in the future. Maintaining these resources becomes more complex and more important as our better-grade sources of metals and liquid fuels become depleted. In this area, the Department of the Interior bears heavy responsibilities.

The Department conducts many programs to discharge its duties in the development and expansion of the Nation's mineral resource base. It gathers and interprets facts on our domestic mineral position, conducts scientific and technological research and investigation, and provides financial aid for private exploration for new sources of critical and strategic minerals and metals.

In addition, the Department acts as minerals adviser to other Federal agencies and conducts programs to promote health and safety standards in mineral industries.

Minerals for Many Purposes

The diversity of our current industrial requirements for metals and fuels, as well as conservation responsibilities for the needs of future generations, complicate the Department's duties in the realm of mineral resources.

In presenting its long-range minerals program to Congress in 1957, for example, the Department listed 75 mineral-commodity groups, each presenting special technological and economic problems.

Although the overall task of developing adequate mineral supplies remains constant, there also are many immediate problems which arise because of rapidly changing conditions. The United States at one time, for instance, was considered deficient in rare-earth minerals, but large reserves have now been discovered. Demands for special fuels and new minerals and alloys have been created as air-defense emphasis shifts. New advances in the field of medicine have established additional markets for high-purity metals, and the peaceful application of nuclear energy requires the development of many different minerals and mineral products.

Research Basic to Action

For Government and industry, the Department collects and interprets facts on mineral reserves, production, and future requirements both in the United States and abroad. Many decisions affecting our economic well-being and military preparedness are based on such data provided to policy planners.

Factual information on our country's present and future mineral position also must be accompanied by recommendations to effect remedies for existing and predicted deficiencies. Our Nation's ability to maintain adequate supplies requires technological programs, long-range in nature, for the discovery of new deposits and for new ways of developing our existing supplies most efficiently. In this field, many programs involve resurveys of submarginal deposit areas, as well as new methods of processing complex and low-grade materials. Thus, the Department is engaged in a never-ending study of all metallic and nonmetallic minerals, rich and poor in quality, to ascertain whether these products can be converted for economic industrial use.

Developing New Supply Sources

Initial production by private industry at the San Manuel copper mine in Arizona in 1956 climaxed a Department of the Interior effort to develop a new source of supply of this important metal. This giant copper deposit—over a half billion tons of low-grade ore, as well as deposits of molybdenum, gold and silver—was discovered and delineated by Department geologists and engineers in an extensive investigation. A similar Department investigation resulted in the development of the Nation's only cobalt mine.

Through the work of the Department of the Interior, many submarginal deposits may become commercial mines in the future. Years often pass between discovery of deposits and initial production; so an adequate appraisal of potential resources must be a constant part of our effort to broaden our natural resource base.

Cooperative Effort

The Department of the Interior has long recognized the importance of developing additional sources of minerals to meet our ever-growing needs, and since 1951 it has promoted the development of critical and strategic minerals through loans to private industry designed to encourage exploration for new sources of supply.

Under this program, an orderly search continues to develop new reserves of raw materials needed to replace supplies which are being rapidly exhausted. The Department, upon approval by its geologists and engineers, supplies a share of the cost of new exploratory work. Repayment of these loans is provided by royalties which are based on the net value of production derived from the newly discovered properties.

While this program was developed during the Korean emergency, the Department recognizes its importance and is recommending new legislation so cooperation between industry and Government can be maintained in the continuing development of essential mineral sources.

Minerals Exploration

Since 1879, the Department of the Interior has had responsibility for providing geologic data necessary for the discovery and orderly development of our mineral and mineral fuels resources. Geologic mapping, basic to all geologic investigations, is being done at a rate of 40,000 square miles per year, but the need for such data outstrips even this rate of progress.

Other geologic research programs in the Department contributing to the development of mineral resources include (1) appraisal of known and potential deposits in mineral-bearing districts; (2) investigation of areas geologically favorable to the occurrence of useful deposits; (3) coordinated long-term field and laboratory research on geologic processes related to the concentration of mineral deposits; (4) research in mineralogy, petrology, geophysics and geochemistry, and the practical application of these skills in seeking new resources; (5) upon occasion, physical exploration to test geologic concepts developed during research investigations and to gather useful data on occurrence, form and size of some types of mineral deposits.

Mining Research

Fundamental mining studies concerning metals and solid fuels also contribute to the broadening of our resources base. Such studies involve the inseparable factors of safety, economy, and efficiency.

A decade ago, for example, the Department of the Interior began the promotion of roof-bolting as a safety measure to curb roof-fall accidents. Since then, it has become evident that this method of roof support also cuts mining costs and increases recovery efficiency.

In bituminous-coal fields, the Department is studying the use of a modified long-wall mining method which, under some conditions, has significantly increased productivity and recovery. Current anthracite-mining research may result in the development of a continuous mining machine which can be used effectively. Additional emphasis also is being placed on the hydraulic mining, transporting, and hoisting of coal, the completion of a roof-control system for mechanized longwall operations, and the development of a rock planer which will be suitable for mining coal and other minerals.

New Metallurgical Contributions

The Department of the Interior has provided the major leadership in many fields of metallurgical research.

Most recently, the Department developed a process for upgrading high-iron bauxite—as part of the continuing program to utilize low-grade ores—which has been incorporated into a commercial production plant now under construction. Private production of titanium and zirconium now is underway in the United States, using processes developed by the Department's Bureau of Mines.

An extensive search is underway for commercially feasible methods of treating our extensive deposits of low-grade manganese ores.

Synthetic Minerals Development

The Department is now engaged also in a quest for synthetic minerals. In this new venture, progress would strengthen the Nation's resource base and simultaneously lessen our dependence upon sources beyond our shores.

Experiments in producing synthetic minerals, although spurred by immediate defense requirements, have long-range economic significance. The Department's efforts to produce synthetic mica and asbestos, for example, could lead to a secure abundant supply of these materials.

Solid Fuels Progress

In solid fuels, the Department of the Interior conducts a broad research program to strengthen the Nation's fuel resources. This research embraces the whole range of fuels from anthracite through bituminous and lignite, for chemical production as well as energy utilization. Technoeconomic studies also are conducted to facilitate the expansion of the coal industry to meet rising future requirements.

Many of the Department's scientific studies have resulted in new solid-fuels tchniques such as development of more efficient coal-preparation methods, making it possible to obtain a satisfactory product from raw coal which is laden with impurities. Particularly significant also is progress to which the Department has contributed in making formerly unsuitable coals and blends usable for coke-making.

To broaden our resource base further, the Department is developing techniques for upgrading and utilizing subbituminous coal and lignites of the West. Gasification of anthracite is also being emphasized to increase the usefulness of this product.

Developing the Nation's Oil and Gas

Petroleum and natural gas are indispensible to our economy and will remain a vital energy source for many decades to come. Development of these fuels has been of continuing concern to the Department of the Interior.

The Department estimates that about 300 billion barrels of oil and a correspondingly large volume of natural gas will ultimately be produced in the United States. In line with past history, new discoveries of reserves and new techniques for more efficient recovery will prompt upward revisions.

As a landlord, the Department controls wide areas of the public domain on which deposits of gas and oil have been and will continue to be discovered. On the outer Continental Shelf, the Department also holds stewardship over vast reserves of gas and oil. Through the years, policies to effectuate the leasing and development of oil on public lands have been in force, and more recently, the Department has moved into the field of leasing offshore drilling rights. It is the continuing interest of the Department of the Interior to encourage efficient recovery methods and conservation practices of these energy reserves within the public domain.

The Department is also the custodian of vast deposits of oil shale. The tremendous resources of liquid fuels locked in oil shale far exceed the total potential of liquid petroleum reserves. Much of the pioneering work involved in the recovery of oil from oil shale has been done by the scientists, geologists, engineers, and technicians of the Department.

The Department's oil and gas activities have stimulated exploration and development of oil and gas. Through the promotion of efficient production methods and effective utilization techniques, significant contributions have been made in broadening the liquid-fuels resource base of our expanding economy.

Helium Supply Problems

Developing a long-range helium program is one of the most important responsibilities of the Department of the Interior.

Demand for this inert, lightweight gas—of which the Department is the sole large-scale producer—has risen 500 percent over the past 10 years to a record peak of 300 million cubic feet annually. Federal agencies use about 75 percent of all helium produced. The remainder is utilized by private industry under Government contracts, with the exception of small but important quantities used for medical research.

Increased requirements have seriously depleted Government-owned helium reserves which, before World War II, seemed adequate for more than a century. The reserves have shrunk to about a decade's supply at present rates of consumption. Helium-bearing natural gas is being produced in greater quantities, but the helium is being lost because the gas is burned without having passed through a helium-processing plant.

With other Federal agencies, the Department of the Interior is giving serious attention to developing a long-range program for the conservation of our helium resources. In 1957, the first step toward improving the Nation's helium position was accomplished when the Department's Bureau of Mines initiated recovery of helium from privately owned natural gas at its Exell, Tex., plant. Continuing efforts should enable both Government and industry to enjoy the fullest possible technical advantages obtainable from our helium resources.

Topographic Mapping

Topographic maps are important basic tools in resources development, and completing and maintaining the national topographic map series is a major activity of the Department of the Interior.

Such fundamental mapping not only meets needs of the military services but supports civil requirements as well, including resources development. It provides the accurate terrain information so essential to an inventory and evaluation of both mineral and water resources. It also serves in the development of these resources through mining and the construction of water-supply, irrigation, and hydroelectric projects and for the development of other resources such as soils and forests.

Safety and Health Activities

Developing safeguards against the hazards, natural and manmade, which beset workmen in mineral industries has been a major responsibility of the Bureau of Mines of the Department of the Interior for many years.

Federal and State inspections, protective devices, proper clothing, and mandatory safety requirements help to promote safety in mineral industries. The Department, in addition, has promoted accident-prevention training as a most potent weapon against occupational hazards in the minerals industry.

Our Nation's resource base is a composite of human and physical elements, and no civilization—regardless of nature's endowments—can progress without healthy skilled manpower. While the safeguarding of manpower is basically humanitarian, tangible returns in the form of increased efficiency and better health add to the more effective utilization and development of our natural resources.

WATER RESOURCES DEVELOPMENT

Water, like the air we breathe, is essential to the survival of all life. Without adequate supplies of water, our factories would grind to a halt, and our fertile fields would turn into barren Saharas. Our civilization depends upon water, and modern-day uses of water touch almost every phase of human activity.

The Department of the Interior has vital responsibilities for the development and conservation of the Nation's water resources, and it administers many programs in an effort to guarantee an adequate supply of water for present and future generations.

Water Demand to Double by 1975

Three basic factors in our expanding national economy emphasize the need for increased water resources development in future years.

Greater use by home and farm and industry is increasing water consumption from an approximate 250 billion gallons daily to an estimated 450 billion gallons per day in 1975.

Population projections show that the country will arrive at a population level of 220 million as early as 1975. If the present rate continues, we may expect that the population will double again in the second half of the century as it did in the first half. The increased demand for water by such an expanding population is self-evident.

Despite present crop surpluses, increased water demand for irrigation use is certain in the near future. Nearly 1¼ million acres of good farmland are lost each year to such things as housing developments, airports, factories, highways, and shopping centers. By 1975 more than 20 million acres of present farmland will be out of agricultural production, and during the same period, our population will have been increased by nearly 60 million people. Long-range planning for an orderly process of resource development is necessary, not only to maintain, but to increase the food supply from our dwindling farm acreage.

Partnership Responsibility

Cooperation and coordination at Federal, State, and local levels in planning the development of our natural resources is of tremendous importance to the Nation. Greatly increased water demands for municipal, industrial, domestic and agricultural purposes is a matter of immediate concern.

Continued rapid growth in population in the United States presages even greater water resources development to supply future economic demands. This is particularly true in the West, where population and industry are expanding more rapidly than elsewhere in the Nation, despite the additional problems posed by an average precipitation which is considerably lower than elsewhere in the United States.

These and other factors in present-day multipurpose water resources development are opening a new era in national economics. To meet this coming challenge, our river water must be utilized to the fullest possible extent before it is permitted to flow into the sea.

This objective can be best attained by cooperative arrangements between Federal, State, and local governments, private industry, associations, and individual citizens in the planning, construction, and operation of water-use facilities.

Irrigation Progress

In 1847 the Mormons undertook the first irrigation of land in the United States. From that beginning, irrigation spread throughout the Western States, and by 1900 about 7½ million acres of land had been placed under irrigation, largely by private initiative and financing.

By that time, the most simple low-cost systems of water diversion and distribution had been built. The growing need of financial and technical aid for further developments in the West culminated in the enactment by Congress and approval by President Theodore Roosevelt of the Reclamation Act of 1902 under which, as amended and supplemented, the water resources development program of the Department of the Interior operates today.

Today, more than 27 million acres of land are under irrigated cultivation in the Western States, and approximately 7 million acres, about one-fourth of the total irrigated area, receive water from facilities constructed by the Department's Bureau of Reclamation.

Multiple-Use Policies Promote Efficiency

A most significant evolution in the growth and development of the West has been the transition from the simple, single-purpose irrigation project to the planned multiple-use projects now used to fully develop available water resources.

Hoover Dam on the Colorado River not only assured a water supply for the great metropolitan area of southern California; it also provided power, irrigation and recreation facilities. The Salt Lake Metropolitan District has contracted for a large share of the water from the multipurpose Provo River project in Utah, and several municipalities in California and in the Great Plains States are receiving many direct benefits from the storage provided in reclamation reservoirs. These municipal and industrial water users repay the Government in full, plus interest, for the Federal investment in their behalf.

Where irrigation was once the only consideration, today's multipurpose natural resources developments also provide outstanding benefits in flood control, power, recreation, industrial, and domestic consumption.

Reclamation reservoirs are used to impound spring snowmelt and rain runoff which would otherwise go unused and cause millions of dollars worth of life and property damage. Hydroelectric power development at multipurpose dams contributes to the energy supply of growing areas. More than 10 million pleasure seekers annually visit the water playgrounds provided by reclamation reservoirs in the West. In many instances, fish and wildlife values are increased by reservoir development.

Irrigation Alleviates Drought

In 1956, when great areas of the West were suffering from an unusually severe drought, the stabilizing influence of irrigation was plainly evident. Irrigated farms constituted the backbone of production even though their own water deliveries were sharply restricted.

The Rio Grande project, for example, delivered less than 1 acre-foot of water per acre, whereas the normal requirement is nearly 3 acre-feet. This small amount, however, was enough to stave off total disaster. Irrigation also made a major contribution to the efforts to save basic breeding herds by sustaining nearly one million head of cattle and a quarter-million head of sheep.

New Projects Under Way

To encourage planning for development of additional reclamation projects, in step with the future economic needs of the Nation, is one of the most important tasks confronting the Department of the Interior.

Projected construction schedules provide for a multiple-purpose water development program which will impound 58,000,000 acre-feet of our unused water resources—enough to supply the irrigation requirements of more than 1½ million acres of land.

The Colorado River storage project, upon which construction has already begun, is a $760 million development, the largest single reclamation project ever to be approved by the Congress.

Preliminary studies are nearly complete for the development of the Garrison diversion unit of the Missouri River Basin project. This plan contemplates a 60-year construction schedule for conveying water from existing Garrison Reservoir on the Missouri River to more than 1 million acres of land in North and South Dakota.

Completion of construction work on the Trinity division of the Central Valley project in California will make available an additional 1,190,000 acre-feet of water for presently irrigated lands. A comprehensive analysis of the Texas water needs and a broad program to meet them is two-thirds complete. Based on this study, fully coordinated water-supply and flood-control projects will be developed.

As administrator of the Small Reclamation Projects Act of 1956, the Department of the Interior processes loans and grants to irrigation districts, public agencies, and the States for the construction of projects similar to those of the regular Federal reclamation program.

Experimental Programs

Experiments are being conducted to develop a practical and economical "chemical shield" to reduce evaporation from lakes and reservoirs. Western reservoirs lose between 3 and 8 feet of surface water each year through evaporation, and laboratory studies indicate it may be possible to save up to 65 percent of evaporated water with a chemical surface coating without harmfully affecting aquatic life. Considering the hundreds of thousands of acres of water surface area in this country, the water savings could be tremendous since the successful use of such a film could have the same result as doubling reservoir capacity.

Salt cedars and other water-using scrub vegetation, which cost the American irrigation farmer an estimated $25½ million loss each year, also are subjects of special weed control and eradication studies.

Loss of water through seepage is another problem currently under attack by experiments for the development of low-cost canal linings. Private business concerns, donating time, equipment, and materials, have rendered valuable cooperation in this research program. Thus far, the research has resulted in several million dollars in water savings on Federal reclamation projects alone.

In the last analysis, wise development of America's water resources will require planning, teamwork, and continued progress in the field of conservation and reclamation to assure adequate supplies of this important commodity to the ultimate consumers—the farmers, industries, and cities—who are dependent upon its supply.

Converting Saline Water

One answer to the growing problem of adequate water supplies is the development of new sources. A practically inexhaustible new source exists in the waters of the oceans. Additional great supplies could be provided by the saline waters of inland areas. The problem is to extract fresh water from the salt water sources at a cost low enough to make possible large-scale use.

Processes are now under development which appear economically promising. These include: Multiple-effect evaporation, vapor-compression distillation, flash distillation, solar distillation, separation by freezing, and several membrane processes.

Process development is carried out by both private and governmental organizations having interest in saline water conversion. The Department is working with the Atomic Energy Commission to determine possible ways in which improved conversion processes can be combined with the generation of atomic energy to offer an overall economic advantage.

As the cost of converting saline water is reduced through research and development, the demand for and the use of converted saline waters will increase rapidly. In the United States, the initial use of additional converted sea water will probably be industrial, and as the costs are reduced, some municipal uses and selected agricultural uses should occur, especially as a supplement to existing supplies.

Power in the Southwest

The Southwestern Power Administration operates an extensive high-voltage electric power transmission system which interconnects Federal hydroelectric powerplants and provides for the integration of Federal and non-Federal power systems in the area. It markets electric power from the Federal transmission system and also through transmission capacity of non-Federal agencies which is made available under contractual arrangements. Power generated at flood-control projects of the Corps of Engineers, Department of the Army, is thereby integrated with power from non-Federal systems to secure an economical and reliable source of electric energy for customers of the Government throughout States in the central Southwest.

In the interest of conservation of our natural resources, comprehensive planning is performed in connection with hydroelectric generation and other purposes for proper coordination in use of water stored in the several Federal reservoirs.

Power in the Southeast

Southeastern Power Administration contributes to comprehensive water resource development programs in the 10 Southeastern States primarily through the marketing of hydroelectric power and energy produced at projects operated by the Corps of Engineers, Department of the Army.

Southeastern Power Administration's power marketing program provides for the generation and integration of power produced from flood-control projects of the Corps of Engineers through contractual arrangements which best meet the needs in the area and provide the most economical power supply. Full consideration is given to the characteristics and location of all power-generating facilities in the area and the regional power requirements.

The Federal projects generally are operated to produce peaking power. Energy is made available on the basis of long-range and day-to-day operational studies showing the most efficient use of available water, and power is dispatched on this basis in accordance with the needs of the power systems into which such power is delivered.

In furtherance of the optimum use of all resources, the Administration contributes to the planning and operational phases of river basin developments with particular regard to power and its coordination with other uses.

Power in the Pacific Northwest

The primary function of the Bonneville Power Administration is to market the electric power and energy produced at hydroelectric projects operated by the Corps of Engineers, Department of the Army, and the Bureau of Reclamation.

The Pacific Northwest is a region dependent upon hydroelectric power to a greater degree than any other area in the United States of comparable size. Because of the inadequacy of the fuel supplies and the availability of a tremendous hydroelectric potential, the Pacific Northwest has developed and utilized hydroelectric power as an energy base.

This area possesses approximately 35 percent of the hydroelectric potential of the United States and approximately 90 percent of the electric energy produced there comes from falling water.

Not only does the Northwest depend upon water for most of its electric energy but it utilizes a far greater proportion of electric power in its energy base than any other part of the United States. In the Northwest electric power supplies almost 30 percent of the total energy used in manufacturing compared to slightly less than 5 percent for the entire Nation.

The Bonneville Power Administration provides the means of marketing the electric energy developed at Federal hydroelectric projects in the Columbia River Basin. The Bonneville transmission grid with approximately 7,500 circuit miles of line forms the main high-voltage transmission system for the Northwest region. This transmission system distributes the power generated at Federal hydroelectric projects to industries, cooperatives, public utility districts, and private utilities. In addition it provides the interconnections which form the Northwest Power Pool—a voluntary organization of 11 public and private utilities serving Utah, Montana, Idaho, Oregon, Washington, and British Columbia, covering an area of approximately 700,000 square miles.

The Northwest Power Pool integrates these 11 utilities to make the most effective use of the water resources available. One of the most important contributions of the Northwest Power Pool to resource development is the conservation of water, made possible by the pool interconnections. With the interconnected pool, water in excess of the loads and reservoir capacity of one utility can be used to generate power to be delivered to other utilities which may store water in their own reservoirs for later use.

The ability of the transmission grid to supply electric energy to widely scattered parts of the Northwest makes it unnecessary to build standby steam-generating facilities in those areas where streamflow conditions make hydroelectric generation inadequate for certain periods each year. This results in a reduction in the investment required for generating facilities as well as a saving of nonreplaceable energy sources such as coal, oil, and natural gas.

Water Studies

In line with the Report of the Presidential Advisory Committee on Water Resources Policy, which stresses the need for more water resources data and for accelerated programs in research and interpretation, the Department's Geological Survey scientists and engineers have increased the amount and tempo of work under way to fill these needs.

Following efforts to determine the tremendous water evaporation losses, studies are now being made on the value of monomolecular films on reservoir surfaces to act as an evaporation suppressant.

Other research teams are investigating the effect on water supplies of worthless upland vegetal cover in arid regions.

Survey investigations into recharging underground aquifers—adding water which would otherwise be wasted to subsurface storage where it can be held without evaporation loss until again brought to the surface—hold much promise for water conservation. At several points in continental United States and Alaska, researchers also are watching glacier growth (or recession) to develop techniques of interpreting the significance of glaciers in relation to available water supplies and long range trends in precipitation.

PUBLIC LANDS DEVELOPMENT

As steward of the public domain, the Department of the Interior, through its Bureau of Land Management, is responsible for managing and developing nearly 477 million acres of unreserved and unappropriated federally owned lands which lie principally in Alaska and the 11 Far Western States. The land itself, the minerals it harbors, and the grasses, wildlife, forests, and water it supports, constitute a large portion of our Nation's natural resources.

The pressures of increasing population, rapid advances in technology, and modern living impose an ever-growing demand upon our natural stores of raw materials, and upon the land for agricultural, industrial, recreational and urban uses. Our public lands are playing an increasingly significant part in satisfying this demand and in contributing to the continued prosperity of our Nation.

Prudent disposal and progressive development of the public lands and their inherent natural wealth, for the greatest benefit to present and future generations, is the fundamental principle which guides the Department in its stewardship of our public lands resource.

The various functional programs which are designed to achieve these objectives are as diverse and technical as are the demands on the land and its resources made by our society and our economy. These programs of comprehensive balanced resource use, development, administration, and disposal are flexible enough to permit orderly expansion or contraction as the demand for program intensity fluctuates.

Development Encouraged

It is essential that development of this great landwealth be a cooperative undertaking and the Department encourages development of the public domain and its resources by State and local governments, by individuals, and by groups of citizens.

Where certain resources, such as minerals, are essential to the Nation's welfare, the Department retains regulatory control over their development and use to guard against waste and depletion. Where other Federal programs can more economically develop the greatest potential of these lands in the best national interest, they are withdrawn and reserved for management by other bureaus of the Department of the Interior and the Federal Government.

While the public lands remain under the control of the Bureau of Land Management, a comprehensive program of conservation, protection, development, and management operates to increase their productivity and enhance their economic value.

Cadastral Surveys

Accurate identification of land areas by location and delimiting boundaries is essential to the orderly and effective management of land and the development of associated natural resources. Cadastral survey operations of the Bureau of Land Management create, reestablish, and identify the public land boundaries, dividing the land into manageable economic units.

Surveys have been extended over large areas of the public domain to permit orderly exploration, location and development of oil, gas, uranium, gold, silver, lead and other mineral resources. Work on leasing maps and the identification of coast lines to facilitate the development of petroleum reserves which underlie the submerged outer Continental Shelf lands of the United States also has assumed a prominent role in the cadastral survey program. The location of the boundaries of the Federal rangelands, a major portion of the public domain in the United States, also is essential to the development of their forage, water, and soils.

Land—the Fundamental Resource

Through a system of field investigation, Federal lands and their natural resources are examined and evaluated to determine their use potential, and public-land laws and mining and mineral leasing laws provide the framework through which the Department identifies the highest use potential of the public domain.

Classification standards determine whether the public lands will be opened to disposal under the nonmineral public land laws. Laws authorizing land disposal are designed to encourage development of the land and its resources by states or by private ownership. The authority to classify lands for retention in Federal ownership forms the primary basis under which the Government develops the material wealth of lands to be retained, insures their use for the benefit of the national economy, and prevents deterioration and waste in the interest of future generations.

The maintenance of records which accurately reflect the history, status, and use of lands and resources is requisite to the orderly development of the public domain. The Department maintains the basic land records, which date to the origin of the United States and are the legal title source for more than 1,800,000,000 acres of private and publicly owned lands. Deterioration from age and increased use have required the revision of records and recording techniques to meet present-day requirements and to insure their permanent preservation.

Rangeland Development

Techniques and practices to develop the forage-producing capacity of the public rangelands include brush removal, reseeding, moisture-retaining soil treatment and conservative grazing use. A 20-year conservation program is now being carried out to reduce soil erosion and prevent the unnecessary loss of moisture from the public lands, thereby increasing the carrying capacity of some 170 million acres of western rangeland for livestock grazing and also to support substantial wildlife. By 1975, depleted vegetation should be restored, and soil and water losses from flood and erosion should be greatly reduced.

Progress is being made in the development of basic livestock operation records and in reappraising the qualifications of range users for grazing privileges. Several new range resource surveys have been activated, in the areas of greatest urgency, to develop basic management planning data. A program of range condition, trend, and utilization studies has been established in each State and is being emphasized in all grazing districts. Such studies provide an evaluation of the range resource and form a guide to proper range use.

Managed Forests

The primary objective of the Department of the Interior with respect to the public-domain forests is to assure their development and use for maximum benefit to the Nation.

The forest areas of unreserved public domain in the United States under the jurisdiction of the Bureau of Land Management aggregate nearly 34 million acres; 4 million of these carry commercial-value classification. The remaining 30 million, classed as woodlands, provide a local supply of fuel wood, posts, poles, and other products, and constitute a large reserve of wood source for potential commercial development.

Forest lands administered by the Bureau of Land Management fall into three categories: the revested Oregon and California Railroad Grant Lands and other lands in western Oregon, generally identified as the O. and C. lands; the public domain commercial forest and woodlands in the continental United States; and the public domain forests and woodlands of Alaska.

The O. and C. lands of western Oregon are destined by law for permanent Federal development and management. They comprise nearly 2 million acres which are now producing or capable of producing a large volume of high-value timber. Their development and perpetual management for the production of trees and wood and fiber, for the greatest economic and social good to the Nation, is the primary objective of the Bureau in its program for these lands.

Forty million acres of commercial and 85 million acres of noncommercial forest under the Department's administration in Alaska constitute an enormous forest reservoir of potential pulp and paper supply. Present efforts of the Department are devoted largely to protection of these forests from fire. The initial steps of a plan for forest inventory have been completed, and data supplied by the inventory will furnish the basis for plans designed to manage these forests, to develop their economic potential, and to supplement domestic wood supplies.

Mineral Exploration on Public Lands

The Department of the Interior administers Federal mining and mineral leasing laws on approximately 800 million acres of land—more than one-third of the total land area of the United States and Alaska.

As agent for the Department, the Bureau of Land Management encourages development and production of the various minerals from the public domain by private enterprise. The primary program objectives are to promote expeditious exploration of the land for the discovery of mineral deposits and to insure their sound development and wise use, thus conserving and extending the supply of mineral resources.

FISH AND WILDLIFE RESOURCES

America's fish and wildlife resources, unlike its mineral resources, are living and renewable. They must be continually developed to provide for regulated annual harvesting by hunters, trappers, and sports and commercial fishermen.

The Federal Government has definite responsibilities for sustaining and augmenting these resources, and the Department of the Interior, through the U. S. Fish and Wildlife Service, is planning a comprehensive development program with the realistic objective of adequately meeting the demands which a growing America will place upon fish and wildlife.

The great interest of the people of this country in hunting and fishing was underlined by a recent nationwide survey which showed that 25 million people 12 years of age and over hunted or fished in 1955.

The Survival of Waterfowl

The future of waterfowl on the North American Continent is a matter of concern to thoughtful conservationists, as the needs of waterfowl are in ever-growing competition with a rapidly expanding human population. Natural marshes of the gulf coast and the Pacific Flyway are being seriously damaged for waterfowl use.

Waterfowl face a precarious future. Major reliance for their survival will have to be on the lands developed for their needs, whether in the ownership of the Federal Government, the States, or private citizens.

Since the Nation's fast-diminishing wetlands are especially vital to waterfowl, special attention was given during the past year to wetland development. Progress was made in retarding drainage and other activities destructive of wetlands, but increased effort is necessary if satisfactory wetlands are to be preserved.

Wildlife Research

An increasing number of hunters are making greater demands on wildlife resources and, to meet the growing demand, the Department of the Interior is developing, through research, methods of utilizing marginal or nonproductive areas and increasing the productivity of existing marshes. Attention also is being given to the development of wildlife management techniques which can be incorporated into farming operations for maximum wildlife production. Timber-stand improvement projects and other forest-management activities are being carefully evaluated to determine their effects on wildlife. Increased study is being devoted to the rapidly growing use of pesticides which, because of their harmful effects on fish and animals, pose a grave problem in the field of fish and wildlife management.

Restoration Programs

Through cooperative wildlife management activities, large areas of privately owned timberland and State-managed refuges are being made available for public hunting grounds. Other continuing Department activities include access-road development, habitat improvement, and fire control.

There also has been increased cooperation among the States in restocking game birds and animals and in managing the wildlife of boundary forests. Waterfowl studies, dove migration surveys, and regionwide disease investigations are being cooperatively developed.

A nationwide program of tree, shrub, and herbaceous crop planting is restoring wildlife in areas of low production. More than 5,000 acres of marsh and 6,000 acres of new fishing water in 37 lakes have been developed, and over a quarter million acres of land have been made available for wildlife and fish restoration activities. These programs are providing needed additional wildlife habitat and recreational opportunities.

Development of Commercial Fisheries

Exploratory fishing has succeeded during the past year in extending commercial fishing boundaries into deeper waters beyond the Continental Shelf. Development and practical application of newer types of fishing gear and modern electronic instrumentation have made wider utilization of fishery resources practical. For example, the first commercial landings of shrimp on the coast of Washington followed the successful search by the Department for new sources of supply.

In many instances, success in developing our commercial fishery resources requires the cooperation of foreign governments. The international fishery commissions, to which the United States belongs, employ exhaustive research and regulatory measures and seek to determine and bring into existence the conditions which will make possible the maximum sustainable yield from the fish resources with which they are concerned.

These efforts have resulted in increasing catches in the Pacific halibut, Frazer River sockeye salmon, and New England trawl fisheries; an understanding of the basic dynamics of the tuna resources of the eastern tropical Pacific Ocean and substantial progress toward a determination of the potential maximum yield from these resources; significant discoveries regarding the migration and distribution of the North Pacific salmon; and major advances in the control of the predatory lamprey in the Great Lakes.

Maintaining the Inland Fisheries

Responsibility for the maintenance of the inland fisheries rests with the States and the Department of the Interior, which restocks waters and manages the game-fish resources on Federal areas or on water-use projects in cooperation with the States. Assistance to the States is rendered wherever possible in research, management of waters, and fish rearing.

In a long-range plan for wise development of fish and wildlife resources, existing Federal fish hatcheries will be modernized and rearing facilities expanded to build up fish stocks on federally controlled areas and to supplement State programs. Several new Federal hatcheries will be built in areas where large water-use projects are developing fish requirements in excess of the production potential of State units.

Developing the Fisheries of Alaska

In 1954, after two decades of substantial decline in the annual yield of the salmon fisheries in Alaska, the Department of the Interior inaugurated an aggressive development program which drastically reduced fishing effort and vigorously enforced fishery laws and regulations. This action was supplemented by a sixfold increase in fishery research in Alaska. The results of the program are encouraging. Spawning streams were well seeded in most areas in 1956, and the salmon pack increased more than 25 percent over 1955 levels.

A system of fishing gear registration was instituted in 1956 to reduce fishing intensity, while other regulations were issued to prohibit salmon fishing, other than trolling, on the high seas in waters contiguous to Alaska under the authority of the North Pacific Fisheries Act of 1954. This action prevented the establishment of a high seas fishery which would have jeopardized the Department's program for Alaska proper.

Fishery Biological Research

Many new devices are being developed to protect our fisheries. Some of these new tools for resource research and management are designed to control the movements of fish to guide them into safe passage at dams and diversions, to control predatory fish, and to control or eliminate the invasion of unwanted or undesirable species into reservoirs or water systems. As research progresses, the large-scale salt water pond cultivation of shrimp, oysters, and clams—all valuable and nutritious food—approaches practicability.

The immediate future holds some challenging opportunities for broadening the base of knowledge upon which our fishery resources may be further developed to meet the growing needs of our people.

INDIAN RESOURCES

The Department of the Interior functions as trustee over Indian lands and resources, which are essentially private property, owned either by individual Indians or tribal organizations. In the development and management of these resources, the interests of the Indian owners, long-range as well as immediate, are given first priority over any other consideration.

During the past 3 years, the Department, through the Bureau of Indian Affairs, has placed increasing emphasis on resource development as an important and effective way of improving the economic status of the Indian people. This program has encouraged a broadening Indian participation in the formulation and execution of resource development programs on the individual reservations.

Developing Indian Oil and Gas Resources

The most dramatic financial result of Indian resource-development programs in recent years has been in the leasing of Indian lands for oil and gas recovery. Over the 5-year span from fiscal 1952 through fiscal 1957, the combined area of Indian lands under oil and gas leases increased from 2,021,822 acres to 5,835,856 acres, and the Indian income from these leases soared to $19,181,053 to $72,616,644.

Many tribes in various parts of the country are now benefiting from oil-exploration operations. In 1949, the first well on the Uintah and Ouray Reservation in Utah was brought in. Discovery of oil in 1951 in the Williston Basin covering considerable Indian land in Montana and the Dakotas set off another large development program. Recent discovery of gas and oil in the "four corners" area of Arizona, Colorado, New Mexico, and Utah is steadily increasing the incomes of tribes in that area.

Construction of additional pipelines to California has resulted in oil and gas development on the Navaho, Jicarilla, Southern Ute, and Ute Mountain Reservations. Discovery of new pay formations in partially developed areas, shallow drilling depth to production, and water-flood projects have brought favorable results on the Osage Reservation in Oklahoma. In 1956, for example, the Osage Tribe received a total bonus of almost $10 million, compared to less than $7 million for the 5 previous years combined.

Other Indian Mineral Resources

The development of other mineral resources on Indian lands has been steadily progressing. From 1952 through 1956, the area under lease for such development increased from 50,385 acres to 197,673. Indian income under these programs has risen from $1,671,797 to $2,881,533. Although there is less uranium exploration than in previous years, this activity is still outstanding in economic importance. Asbestos, coal, iron, sand and gravel, phosphate, lead, and zinc are also being developed.

Forest Resources

Developing the forest resource base on Indian lands includes three principal activities. First, more complete information on timber resources is being obtained through new inventories and a redetermination of growth potential. Secondly, closer utilization and reduction of waste are being accomplished by changes in timber-sale methods. Finally, improved methods of protection against fire, insects, and disease are being developed.

The awakening public interest in resource development is reflected in increased appropriations for management of all forests under Federal supervision, including Indian lands. Some tribes also have increased the amount of tribal funds earmarked for forest management and protection. One result is an increasing number of reservations for which urgently needed forest inventories have been obtained. With these inventories, the allowable annual cut under sustained-yield management is anticipated, and efforts are being made to bring the annual harvest up to the allowable maximum.

Agricultural Lands

Since the 1880's, more than 170 irrigation systems have been developed on Indian reservations in the western states, irrigating 870,000 acres of land. These projects vary in size from a few acres to more than 120,000 acres. Three electric power generating distribution projects have been authorized and constructed in connection with irrigation projects on Indian lands. Water storage reservoirs now have a capacity of 2 million acre-feet, and in addition, supplemental water is provided by storage in reclamation reservoirs for about 200,000 acres of Indian lands.

Through soil and moisture conservation programs, guidance and assistance are provide for the Indians in development of land according to its needs, its uses, and its capabilities. Indian-owned rangelands support approximately 975,000 cattle units of livestock with an annual value of over $6 million. Substantial income also is produced on these lands in the wildlife, scenic, and recreational areas. A good portion of the income provided by these sources is being reinvested in water conservation, reseeding, and other resource development projects.

Objectives of Indian Programs

The Department has trust responsibility for more than 39 million acres of tribal lands and 14 million acres of allotted Indian lands.

While these Indian assets are held in trust, it is the aim of the Department to assist the Indians in obtaining maximum return from the use and development of their resources consistent with good management and conservation concepts; to preserve the renewable resources in a perpetually productive state; and to renew the productivity of those resources which have deteriorated.

Although management of these lands is still a Federal responsibility, the Department encourages the Indians to prepare for eventual assumption of full responsibility and authority.

TERRITORIAL RESOURCE DEVELOPMENT

The Department of the Interior is responsible for the development of the natural resources of the 3,160,000 people who reside in Alaska, Hawaii, the Virgin Islands, Puerto Rico, Guam, American Samoa, and the trust territory of the Pacific Islands.

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To promote the effective and prudent development of the natural resource base of America's Territories and trust possessions, the Department, through the Office of Territories, fosters a climate of self-government which is essential to the current welfare and future prosperity of territorial populations.

The Territories, particularly Alaska, constitute a major portion of the undeveloped natural resources of our Nation, and the efforts of the Department in developing these new resources fall into many categories.

Departmental Interests Varied

The jurisdiction over the development, use, and conservation of territorial natural resources is not confined to a single office of the Department, and many bureaus are concerned with broadening the resource base of the Territories.

The Bureau of Land Management is responsible for the administration and development of nearly 500 million acres of land, about three-quarters of which lies in Alaska.

The Bureau of Mines conducts research and development programs important to the development of Territorial mineral resources, and the Bureau of Reclamation is concerned with hydroelectric generating potential and water conservation practices in the various territories.

The Fish and Wildlife Service is responsible for the development and administration of fishing regulations, fishery research programs, and wildlife conservation in the territories.

The Geological Survey devotes a substantial portion of its activities to the mineral, fuel, and water resources of Alaska and the other Territories. Mineral geology and water resources in Guam are receiving attention, and the water well sites on American Samoa are being located by the Survey.

Hawaii and the Trust Territories

Hawaii possesses great wealth in lush agricultural land, in scenery, and in climate. For the most part, these natural resources have been developed wisely, and further plans call for continued broadening of the Hawaiian resource base through such activities as the Waimea and Molokai irrigation projects.

In the Trust Territory of the Pacific Islands, the Department of the Interior is responsible for the development of the air and water transportation systems which are absolutely vital to the advancement of the islands' economic life, but are not as yet attractive to private enterprise. Furthermore, the land resources of these areas, of Guam, and of American Samoa are so meager that the Federal Government has a special responsibility to protect and develop them.

The Wealth of Alaska

The story of the development of the natural resources of the Territories inevitably centers on the vast land and water areas of Alaska. It is many times larger than the rest of the territorial areas of the United States; moreover, Alaska contains great reserves of undeveloped natural resources.

In Alaska only the commercial fisheries and certain mineral operations, such as gold mining, have been extensively developed. The vast coastal forests are in the initial stages of utilization, and the search for oil and gas is still in the exploratory and discovery stage. Currently, the development of many important resources in Alaska is not yet economically feasible because of poor transportation or market location.

Expanding the Resource Base

In Alaska's resource development, exclusive emphasis is no longer placed on the standbys of fur, fish, and certain minerals. Other sources of natural wealth are being developed to give more stability, diversity, and permanency to Alaska's economic base.

An important beginning has been made in this direction by the large-scale utilization of the forest and agricultural resources of the Matanuska, Kenai, and Tanana Valleys. Increased oil exploration and the initial development of some of the Territory's immense hydroelectric resources also are contributing to the rapid growth of a prosperous Alaska.

Alaskan Minerals and Forests

While favorable petroleum structures have been located in various parts of Alaska, drilling has not yet brought in fields of major importance. Vast areas are under lease, however, and extensive exploration is being conducted. The U. S. Navy has discovered large reserves in northern Alaska, and the Department has received many requests that these lands be opened for mineral and mining exploration and development.

The first large-scale development of Alaskan timber resources began in 1954 with the opening of a $50 million pulp mill near Ketchikan. Plans have now been initiated for the development of additional pulp mills at Sitka, Juneau, and Wrangell. The proposed

Sitka mill, sponsored by Japanese interests, is supported also by American capital.

There has been increased interest in mineral development during the past year in the Klukwan iron-ore deposits, north of Haines, and the Department is sponsoring legislation which will make possible the leasing of these lands for development.

THE NATIONAL PARK SYSTEM

The congressional mandate, which established the National Park Service as a constituent bureau of the Department of the Interior 41 years ago, directed the Department "to conserve the scenery and the natural and historical objects and wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

The spectacular rise in visits to the national park areas demonstrates the enjoyment the American people derive from this priceless heritage. Park visitors in calendar year 1956 totaled nearly 55 million, up 10 percent over the preceding year and more than 150 percent above the 1946 figures. In the first 6 months of 1957, park visitors totaled 23,302,520, as against a total of 21,338,076 for the same period in 1956, indicating that attendance for the full year will approach the 60 million mark.

Unlike resources which yield material things, the parks provide such precious cultural and inspirational intangibles as knowledge of nature, spiritual refreshment, and wholesome recreational opportunity. Intelligently managed and used, these resources can be drawn upon almost endlessly without depletion, but if destroyed by misuse they are lost forever.

Mission 66

The past fiscal year provided tangible evidence of the benefits in store for this and future generations under the Mission 66 program of park development which was inaugurated on July 1, 1956.

Mission 66 is designed to develop the irreplaceable natural, scientific, and historic resources entrusted to the care of the Department of the Interior for the enjoyment and inspiration of millions of Americans. At the same time, the accumulated inadequacies and abuses of past years will be eliminated.

In its first year, Mission 66 has made dramatic progress toward providing the facilities and services required to cope with the rising tide of visitors. More than 650 park improvement projects had been programed and 113 completed by the end of the fiscal year.

When its goals are reached in 1966—the golden anniversary of the establishment of the National Park Service—Mission 66 will provide the American people with a national park system properly developed and adequately staffed to keep abreast of the increasing interest of our people in the great outdoors and in our historic and prehistoric past.

First Year Developments

Among the facilities placed in operation in the past year were: seven new visitor centers and major addition to four others; 83 new wayside interpretive installations to provide better understanding of the parks; new and improved campsites with facilities for some 8,000 additional campers daily; 56 new comfort stations; parking facilities for an additional 7,500 automobiles; and 51 new or improved water systems. Some 185 miles of run-down park roads are undergoing reconstruction and improvement and 39 miles of new roads were completed.

In addition, private enterprise invested some $7,200,000 during the year to expand overnight accommodations, restaurants, stores and other public service installations in the parks, resulting in accommodations for an additional 2,500 visitors.

Diminishing Recreational Resources

The supply of open spaces suitable for recreational development is rapidly vanishing. How rapidly was demonstrated in the National Park Service report, Our Vanishing Shoreline, issued in July 1956. This report summarized findings of a survey of the Atlantic and gulf coasts with this statement:

"Almost every attractive seashore area on our Atlantic and gulf coasts has been preempted for commercial or private development. Only a fraction of our long seacoast is left for public use and much of this small portion is rapidly disappearing before our eyes."

As the fiscal year ended, a similar survey was in progress along our Great Lakes and Pacific shoreline, and more detailed followup studies were under way along the Atlantic and gulf coasts.

Historic Areas

The great scenic areas of the national park system are augmented by the cultural contributions of the historic areas which encompass the whole range of our prehistoric, colonial, and national history.

More than 13 million Americans visited these historic shrines in 1956, strengthening their understanding of our inspiring past and reinforcing their faith in the future of our democracy. In the first 6 months of 1957, visitation to the historic areas was running 16 percent higher than last year.

New Areas Established

On December 1, 1956, the Virgin Islands National Park on the beautiful island of St. John in the United States Virgin Islands was formally opened and dedicated as our 29th national park, and the Booker T. Washington National Monument was established near Rocky Mount, Va., on June 18, 1957.

Two new national historic sites were established during the year—the Golden Spike National Historic Site at Promontory, Utah, and Chimney Rock National Historic Site near Bayard, Nebr.

Some 52,000 acres of private holdings within the boundaries of the national parks were acquired during the year by purchase, donation, or exchange and, as the year ended, the National Park Service administered 182 areas embracing 25,100,000 acres, of which 24,421,000 were federally owned.

As the American people in the years ahead draw ever-increasing dividends of healthful recreation and patriotic inspiration from the great resources of our park system, the Department of the Interior's program of sound development will help provide the safeguards to assure that these resources will be passed along unspoiled and undiminished for the enjoyment of future generations.

SECRETARY
UNDER SECRETARY

TECHNICAL REVIEW STAFF

Field Committees

DIVISION OF INFORMATION

SOLICITOR

Legislative Counsel

ASSISTANT SECRETARY
FISH AND WILDLIFE

COMMISSIONER OF FISH AND WILDLIFE

BUREAU OF SPORT FISHERIES & WILDLIFE
Migratory bird law enforcement
Research
Management Field Services
Animal Control
Federal Aid for Fish – Wildlife
River Basin Studies
4 Wildlife Research Stations
99 Fish Hatcheries & Laboratories
273 Wildlife Areas of 17,000,000 acres

BUREAU OF COMMERCIAL FISHERIES
Market Development
Management Research
Loans and Grants
Enforcement
Protection of Sea Mammals
7 Market News Offices
24 Research Stations
15 Seagoing research vessels

MARCH 3, 1849

ASSISTANT SECRETARY
PUBLIC LAND MANAGEMENT

BUREAU OF LAND MANAGEMENT
Administration of 440,000,000 Acres of Public Domain
Range & Grazing District Management
Forest Management
Issuance of Mineral Leases on Public and Acquired Lands
Outer Continental Shelf Mineral Leasing
Official Public Land Cadastral Surveys
$112,059,358 Receipts in Fiscal Year 1957
Keeping of the Basic Public Land Records

NATIONAL PARK SERVICE
Scenic, Historic, Scientific Areas
Recreational Planning
29 National Parks
4 National Recreation Areas
148 Other Areas, Variously Classified
More than 24,000,000 acres
6,678,871 Visits to National Capital Parks
Nearly 55,000,000 Visits to Other Areas

BUREAU OF INDIAN AFFAIRS
Indian Land & Water Development
Economic Rehabilitation
Education & Welfare
400,000 Indians
57,500,000 Acres of Land (inc. Alaska)
$75,000,000 from Mineral Leases & Sales

OFFICE OF TERRITORIES
Alaska, Alaska Railroad
Alaska Public Works
Hawaii, Guam, Virgin Islands, American Samoa, Trust Territory
The Department also has general jurisdiction over the Governments of nearly three million persons in the Territories and Island Possessions of the United States, and in the Trust Territory of the Pacific Islands.

ASSISTANT SECRETARY
MINERAL RESOURCES

GEOLOGICAL SURVEY
Basic Mineral, Water, Topographic & Geologic Data
Geologic Research & Mapping
Supervision of Development of Federal Mineral Leases
$80,000,000 in Mineral Royalties
6,940 Stream Gaging Stations
120,000 sq. miles of Topographic Mapping yearly

BUREAU OF MINES
Mining Research – Mineral Technology
Mineral Economics – Mine Safety
26 Research Stations – 34 Field Offices
4 Helium Plants
242,926,632 cu. ft. of Helium produced
15,000 Ore Samples tested for radioactivity
17,174 Coal Mine Inspections
8 fires in coal beds extinguished (bringing coal saved since 1949 to around 268 million tons).

DEFENSE MINERALS EXPLORATION ADMINISTRATION
Assistance for Minerals Exploration
3,518 Applications received to March 31, 1957
1,007 Contracts totalling $47,561,000 with $29,390,000 Government participation, resulting in 289 certified discoveries.

OFFICE OF MINERALS MOBILIZATION
Defense minerals and solid fuels programing and readiness projects.

OFFICE OF OIL & GAS
Coordinate Federal Oil and Gas Policy
Administer Connally Act

OFFICE OF GEOGRAPHY
Secretary's operational responsibility in standardizing geographic names for use on maps and in other publications
2,000,000 standardized geographic names
3,000,000 names edited on maps and texts

ASSISTANT SECRETARY
WATER AND POWER DEVELOPMENT

BUREAU OF RECLAMATION
Water Resources Planning & Development
Irrigation – 7,658,801 acres of irrigable land in Reclamation projects service area in 17 Western States. Federal Reclamation Project facilities in service include 140 storage dams and reservoirs, 106 diversion dams, 24,400 miles of canals and laterals, and 7,800 miles of drains.
$7,851,769 Income from Water Sales
$3,084,584 Income from Operation & Maintenance
Municipal & Industrial Water
$523,865 Income from Water Sales
Power Generation, Transmission & Marketing
5,808,050 kw Installed Capacity
9,855 Miles of Transmission Lines
$60,157,971 Income from Power Sales

BONNEVILLE POWER ADMINISTRATION
Transmission & Marketing Electric Power
4,139,000 kw Installed Capacity
7,195 Miles of Transmission Lines
$60,992,623 Annual Revenue

SOUTHWESTERN POWER ADMINISTRATION
Transmission & Marketing of Electric Power
501,000 kw Installed Capacity
1,000 Miles of Transmission Lines
$8,183,030 Annual Revenue

SOUTHEASTERN POWER ADMINISTRATION
Marketing of Electric Power
1,031,000 kw Installed Capacity
$11,444,558 Annual Revenue

OFFICE OF SALINE WATER
Development of economically feasible processes for reclaiming saline waters
21 Research & Development Contracts

ADMINISTRATIVE ASSISTANT SECRETARY

DIVISIONS OF

Administrative Services: Reproduction; office space; communication facilities; warehousing; shipping; library; dispensary; and Office of Secretary administrative services.

Budget and Finance: Coordinates the development, preparation and execution of the Departmental budget; develops and reviews operation of financial programs.

Inspection: Special inspections; investigations; development and enforcement of inspection policies and procedures.

Management Research: Management advice and improvement; organizational review; incentive awards; Secretarial directives system.

Personnel Management: Position classification; labor relations; wage administration; recruitment; placement; examining; training; employee relations; and health and safety.

Property Management: Procurement, utilization and disposition of real and personal property; construction contracting; radio communications; and records.

Security: Personnel security; security of documents and materials; physical security of facilities and equipment; coordination of civil defense activities.

FIGURE 1.—Organizational Chart of the Department of the Interior.

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PART II

ANNUAL REPORTS OF THE BUREAUS AND OFFICES OF THE DEPARTMENT OF THE INTERIOR

Office of the Assistant Secretary
Water and Power Development

Fred G. Aandahl, *Assistant Secretary*

THE ASSISTANT SECRETARY for Water and Power Development discharges the duties of the Secretary with respect to the Department's programs in the field of water and power development. The Assistant Secretary exercises secretarial direction and supervision over the Bureau of Reclamation, Bonneville Power Administration, Southeastern Power Administration, and Southwestern Power Administration. The principal function of the latter three agencies is to market surplus power generated in their respective areas at Federal projects. The Bureau of Reclamation constructs water-use projects whose primary purpose is the reclamation of arid and semiarid lands in the West, and also markets surplus power produced at Federal projects in the West outside the boundaries of the Bonneville Power Administration and Southwestern Power Administration and at Falcon Dam on the Rio Grande River, an international project. The Assistant Secretary for Water and Power Development is also responsible for carrying out the defense functions of the Secretary with respect to electric power and for supervising and directing the Office of Saline Water. The activities of the water and power agencies of the Department and the Office of Saline Water are more fully described in sections of this report covering each of the Department's bureaus and offices.

The table on the next page, prepared on a consolidated basis for fiscal year 1957, shows the installed capacity of plants whose power is marketed by Interior Department agencies, net energy generation, energy marketed, and gross revenues.

The Assistant Secretary for Water and Power Development participated in the negotiation of contracts for the marketing of power and integration of power systems in the operating areas of the South-

Power Production and Marketing Data, Fiscal Year Ended June 30, 1957

Marketing agency	Installed capacity, as of June 30, 1957 (kilowatts)	Net energy generated (million kilowatt-hours)	Energy marketed (million kilowatt-hours)	Gross revenue (thousands of dollars)
Bureau of Reclamation	[1] 5, 808, 050	26, 261	[4] 11, 611	[5] $43, 845
Bonneville Power Administration	[2] [3] 2, 434, 000	15, 864	28, 216	64, 762
Southeastern Power Administration	[2] 1, 126, 000	2, 500	[6] 2, 546	13, 644
Southwestern Power Administration	[2] 501, 000	1, 367	[6] 1, 876	8, 772
Total	9, 869, 050	45, 992	44, 249	131, 023

[1] Includes 745,000 kilowatts in Corps of Engineers, 31,500 kilowatts in International Boundary and Water Commission, and 5,031,550 kilowatts in Bureau of Reclamation projects.

[2] Capacity in Corps of Engineers projects.

[3] Bonneville Power Administration also markets power from Bureau of Reclamation Grand Coulee, Hungry Horse, and Chandler powerplants with a capacity of 2,271,000 kilowatts. (This amount included in Bureau of Reclamation installed capacity.)

[4] Excludes 14,043 million kilowatt-hours delivered at Grand Coulee, Hungry Horse, and Chandler powerplants by Bureau of Reclamation to Bonneville Power Administration. (This amount included in Bonneville Power Administration energy marketed.)

[5] Excludes $16,308,000 revenue received by Bureau of Reclamation from Bonneville Power Administration. (This amount included in Bonneville Power Administration gross revenue.)

[6] Includes purchased energy.

western Power Administration and Southeastern Power Administration. Negotiations were completed and contracts were signed with two generating and transmission cooperatives for them to meet electric powerload growth through independent expansion of the cooperatives' production and transmission facilities. Major changes in other generating and transmission contracts were negotiated to comply with the directive of Congress that power should be delivered, insofar as practicable, at a uniform rate in the Southwest. In the Southeast, negotiations were conducted to market the output of Buford, Allatoona, and Clark Hill projects under a single contract similar to the Clark Hill arrangement, which was placed in operation on June 20, 1956. Arrangements for the marketing of the output of the Jim Woodruff project power in the northern Florida area are nearing completion through a wheeling and firming arrangement involving public and private utilities in the area.

The Assistant Secretary for Water and Power Development directed the preparation of an average rate and repayment study to determine the requirement for rates for the sale of electric power in the Southwest area. Existing rate schedules that were initially approved in 1947 have been found to be deficient and will not produce repayment of Federal investment on a 50-year basis. Therefore, new proposed rate schedules were developed to produce sufficient revenue to repay costs within 50 years. On November 16, 1956, the Assistant Secretary requested the Federal Power Commission to approve and confirm these proposed rate schedules.

The Commission approved and confirmed the rates on August 9, 1957. The Assistant Secretary also directed the preparation for submission to the Senate Committee on Interior and Insular Affairs of a statement on the Missouri River Basin project, relating to the physical plan of development, water and power rates, basis of project payout, cost allocations, reservoir operation, and power marketing.

Progress has been made on an important power cooperation program initiated last year. Approval was given the Bonneville Power Administration to enter into long-term contracts with non-Federal generating utilities for transmission of power over the Federal transmission grid in the Northwest. This program is intended to produce more complete regional integration and secure the most economical use of resources. Bonneville Power Administration will construct feasible additional transmission facilities as needed, and reimbursement to the Government will be on a use-of-facilities basis.

During the fiscal year, the Department through the Assistant Secretary for Water and Power Development reviewed 31 reports of the Corps of Engineers, Department of the Army, primarily for flood control and navigation improvements; 38 Federal Power Commission applications for permits and licenses for hydroelectric developments; one report of the Public Health Service, Department of Health, Education, and Welfare, for water pollution control; and one proposal of the International Boundary and Water Commission for construction of control dams in the channel of the lower Rio Grande River.

The Assistant Secretary for Water and Power Development participated in the interagency study of western drought problems centering on the President's tour of the distressed area.

The Assistant Secretary served as departmental representative on the Interagency Committee on Water Resources and participated in the joint field conference of interagency committees for the Missouri and Arkansas-White-Red Basins. He also served on the President's Advisory Committee on Public Works. The Assistant Secretary conducted field conferences on power marketing, land limitation in the Columbia Basin, and irrigation development. Staff of the office served as departmental representatives on interagency committees concerned with radio frequency allocation, turbine procurement, international water developments, public works planning, coordination of water resources projects, cost allocations, financial practices for water and power projects, economic analyses, atomic energy, and allied technical subjects.

Other significant activities of the Assistant Secretary and his staff included testimony before congressional committees on the Fryingpan-Arkansas, Trinity, Missouri River Basin, other reclamation projects, land acquisition at reservoirs, and standards for water development projects; a special study of drainage problems at the Yuma project; further discussions of potential Canadian storage reservoirs; and reappraisal of irrigation benefits and price levels with the cooperation of the Department of Agriculture.

BUREAU OF RECLAMATION

Wilbur A. Dexheimer, *Commissioner*

Introduction

THE BUREAU OF RECLAMATION in 1957 fiscal year made important contributions to the Nation's resource base by teamwork with other Federal agencies and State and local government units, private industry, and citizens in the development of the water and land resources in the Western United States.

About $130 million were converted into wealth-creating reclamation facilities available to serve the West and the Nation. Purchases from these expenditures were reflected in the flow of business in each of the 48 States.

Construction completed during the year added more than 160,000 acre-feet of storage space in new Reclamation project reservoirs, 57,000 kilowatts of hydroelectric generating capacity, 117 miles of canals, aqueducts, and related water conveyance and distribution structures, and 526 miles of large electrical transmission lines.

A notable event was the start of construction on the Colorado River Storage Project. On October 15, 1956, President Eisenhower pressed a gold key at the White House to signal the explosion of simultaneous initial blasts in the construction of Glen Canyon Dam in Arizona and Flaming Gorge Dam in Utah.

These are key structures in the project which will make possible the development of the vast Upper Colorado River Basin's irrigable lands and abundant resources of fuel, oil, minerals, and timber. Urgently needed water will also be supplied to municipalities and other benefits will be obtained from recreation, fish and wildlife conservation in the Upper Basin, and from sediment retention and river regulation for power production and flood control in the Lower Basin.

The Bureau is responsible for overall supervision of the care, operation and maintenance and replacement of facilities capable of delivering irrigation water to more than 7½ million acres of land—more

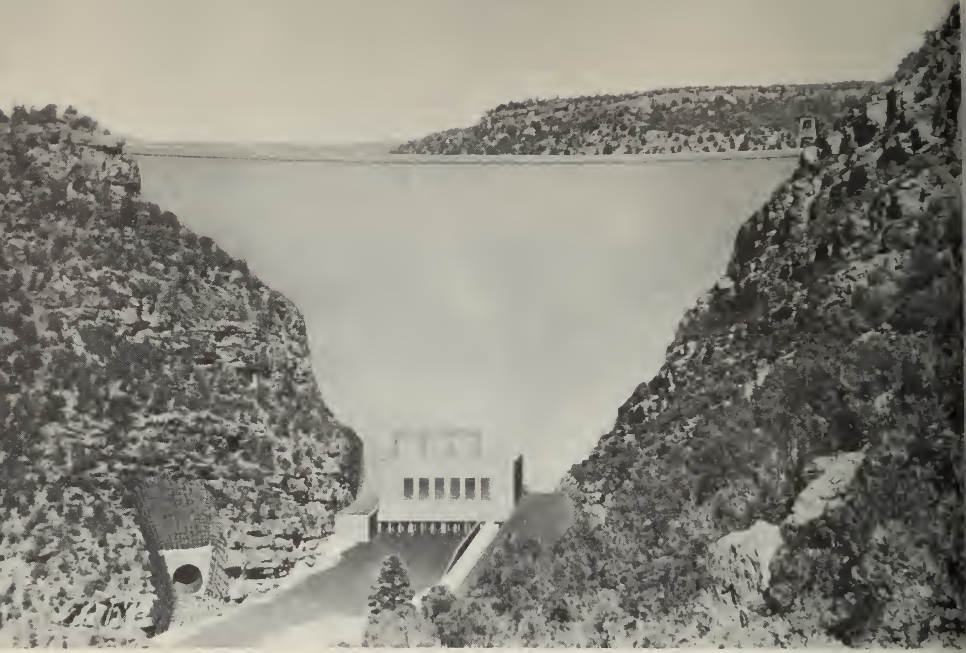

Figure 2.—Flaming Gorge Dam. An artist's conception of Flaming Gorge Dam when completed on the Green River in Utah gives an idea of the size of the key storage structures on the Colorado River Storage Project. Under the project, a total of 132,360 acres of new land in the five-State area will receive water and, in addition, 234,000 acres of land already under cultivation will receive supplemental water. More than 1 million kilowatts will be added to Upper Basin electric power capacity.

than one-fourth of the total irrigated land area of the Western United States. Most of the facilities are operated by local water users organizations which have contracted with the Government for repayment of a share of the construction costs.

This is in accordance with a longstanding policy and the Bureau of Reclamation has been diligent to transfer the responsibility for operation and maintenance of irrigation projects to the water users. With a few exceptions, the Bureau actually operates and maintains only the reserved works of multipurpose projects, while the balance of the facilities are operated and maintained by the various irrigation districts.

During fiscal year 1957, the irrigation distribution facilities serving approximately 85 percent of the total irrigable acreage included in Federal Reclamation projects were operated and maintained by the water users. Because of its investment in these projects, however, the Federal Government, through the Bureau of Reclamation, is responsible for inspection and for general supervision of operation of all of the project facilities.

The total harvest from all Reclamation projects in calendar year 1956 was valued at more than $951.6 million, an average of $148.69 per irrigated acre. Irrigable lands for service totaled 7,658,800 acres, of which 6,400,140 acres were actually irrigated. As compared to 1955, this represents an increase in irrigation of 138,380 acres.

Half of the area of the Reclamation West lay in the clutch of severe drought in calendar year 1956. Arizona and New Mexico, suffering from drought since 1942, experienced continued shrinking of reservoir supplies, runoff, and ground water levels. From Nebraska southward, the "grey belt" of irrigation which traditionally changes from subhumid to semiarid turned completely arid. Parts of Utah and Colorado likewise withered under almost unprecedented drought conditions.

So acute and widespread was the plight of thousands of farmers and hundreds of cities and towns that the President, accompanied by the Secretaries of Interior and Agriculture, made a special tour of the drought-stricken area in mid-January 1957. Bureau of Reclamation planning efforts were intensified following his visit and have already resulted in one project, San Angelo, Tex., being authorized by the Congress.

The stabilizing influences of irrigation have been evident throughout the drought-stricken areas. Large proportions of the immediate feed shipments into the drought areas of Texas and New Mexico originated on irrigated farms. The scattered irrigated farms constituted the backbone of production in the West although water supplies were severely restricted. The Rio Grande Project in Texas, for example, delivered less than 1 acre-foot of water per acre, whereas the normal irrigation requirement is nearly 3 acre-feet.

Nevertheless, handicapped as they were by drought, irrigation facilities in Reclamation Region Five, embracing the States of Texas, New Mexico, and Oklahoma, contributed substantially to the saving of the basic breeding herds of cattle on adjacent ranges, where irrigated farms sustained nearly one million head of cattle and more than a quarter of a million head of sheep. In addition, these farms provided sufficient feed to produce 371 million pounds of beef. Other irrigated areas in nearby States supplied grain and forage to sustain livestock herds and to carry on the regular cattle and sheep fattening enterprises.

The public acclaim and recognition of the bolstering effects which irrigation is able to produce during periods of extreme drought was manifested in the increased private ventures into well irrigation and by continued requests for Bureau assistance in solving major water supply problems in the West.

The snow pack in the Columbia River Basin this year was near normal; however, sustained high temperatures in April and May resulted in unusually high rates of flow in some areas. Operation of Bureau reservoirs in Region One—Washington, Oregon, Idaho, and western Montana—resulted in substantial reductions in downstream flows particularly on Upper Snake River and on the Boise, Payette, Owyhee, Malheur, and Flathead Rivers in Idaho. Except for Hungry Horse Reservoir in Montana and Lake Roosevelt in Washington, the Bureau's reservoirs were operated to reduce flooding in the local areas of the reservoirs. Storage in these reservoirs did, however, reduce the peak flow on the Lower Columbia River by more than 100,000 cubic feet per second and reduced the river stage at The Dalles, Oreg., approximately 2.5 feet.

Estimates indicate that in 1956, more than 12 million persons enjoyed the use of recreational facilities on the 140 principal Federal Reclamation reservoir areas in the 17 Western States. These water playgrounds are made available for public use through cooperative administration arrangements among the Bureau, the National Park Service, the United States Forest Service and State and local governmental agencies.

Guided tours were provided at Hoover Dam and Powerplant on the Boulder Canyon project in Arizona and Nevada; Shasta Dam and powerplant on the Central Valley project in California; Hungry Horse Dam and powerplant on the Hungry Horse project in Montana; Grand Coulee Dam and Powerplant on the Columbia Basin project in Washington; and Granby Pumping Plant on the Colorado Big-Thompson project in Colorado. Self-guided tours were initiated at Davis Dam and Parker Dam on the Colorado River between Arizona and Nevada and Arizona-California, respectively.

A folder "Reclamation's Recreational Opportunities," prepared in 1956 at the request of the House Interior and Insular Affairs Committee, has proved such a "best seller" that a second reprinting was necessary and is now available for sale through the Superintendent of Documents, United States Government Printing Office.

The 77 Reclamation irrigation projects, located throughout the 17 Western States, are divided into seven regions for administrative purposes. States located mainly within each region, and regional headquarters, are as follows:

Region 1.—Washington, Oregon, Idaho, and western Montana; Boise, Idaho.

Region 2—California, except southern portion; Sacramento, Calif.

Region 3.—Arizona, southern California, and southern Nevada; Boulder City, Nev.

Region 4.—Nevada, Utah, western Colorado and southwestern Wyoming; Salt Lake City, Utah.

Region 5.—Texas, New Mexico, Oklahoma, and southern Kansas; Amarillo, Tex.

Region 6.—Eastern Montana, North Dakota, South Dakota, and northern Wyoming; Billings, Mont.

Region 7.—Eastern Colorado, Nebraska, northern Kansas, and southeastern Wyoming; Denver, Colo.

IRRIGATION AND CROP PRODUCTION

During fiscal year 1957, the Bureau of Reclamation was responsible for overall supervision of the care, operation, maintenance, and replacement of facilities capable of delivering irrigation water to more than seven and one-half million acres of land—more than one-fourth of the total irrigated land area of the Western United States.

1956 Crop Production

The total harvest from all Reclamation projects in calendar year 1956 was valued at over $951.6 million, an average of $148.69 per irrigated acre. Irrigable lands for service totaled 7,658,800 acres, of which 6,400,140 acres were actually irrigated. As compared to 1955, this represents an increase in irrigation of 138,380 acres.

Forage crops were produced on 46.9 percent of the net area irrigated on all Reclamation projects, and 24.3 percent of the irrigated lands were utilized in producing cereals. The crops within these two groups, totaling more than 15.4 million tons, are utilized principally as livestock feeds, generally in the local areas of production.

Over 5.9 million tons of fresh vegetables, fruits, and nuts were produced from 739,780 acres of irrigated lands. Dry miscellaneous food crops such as dry beans, sugar beets, mint, hops, etc., totaling over 6.5 million tons, were produced from almost 666,000 acres. Data on crop production by crop groups follow:

Crop group	Irrigated crops		Gross crop value	
	Acres	Percent of total	Dollars	Percent of total
Cereals	1, 560, 894	24. 39	103, 740, 325	10. 90
Forage	3, 001, 023	46. 89	180, 814, 785	19. 00
Field crops, miscellaneous	1, 115, 178	17. 42	265, 202, 730	27. 87
Seeds	278, 198	4. 35	30, 748, 600	3. 23
Vegetables	466, 518	7. 29	179, 160, 636	18. 83
Fruits and nuts, and miscellaneous	295, 819	4. 62	165, 831, 115	17. 42
Other [1]	----------	----------	26, 125, 465	2. 75
Total reported	6, 717, 630	104. 96	951, 623, 656	100. 00
Less: Multiple cropped	453, 778	7. 09	----------	----------
Plus: Soil building crops	14, 623	. 23	----------	----------
Cropland not harvested	121, 668	1. 90	----------	----------
	6, 400, 143	100. 00	951, 623, 656	100. 00

[1] Additional revenues from Federal and commercial agencies.

The volume of agricultural production totaled nearly 28.4 million tons in 1956, an increase of 1.4 million tons over 1955. Increases were noted for all crop groups except fruits, which decreased about 61,000 tons. The production of cotton was up 99,000 bales, sugar beets increased 544,000 tons, and dry beans fell off about 23,000 tons. Average per acre crop yields were slightly higher than in 1955 for the principal crops produced on most Federal irrigation projects. In all, 1956 was a good crop year.

Average unit prices received by irrigation farmers for their products were generally somewhat higher than in 1955. This was true for all the principal crops except alfalfa hay and canning tomatoes, which decreased 5 and 6 percent, respectively, in 1956.

The most significant crops produced on irrigated project lands in terms of value were cotton, alfalfa, potatoes, sugar beets, grapes,

FIGURE 3.—Irrigated crops like these Columbia Basin project potatoes in Washington State are included in annual Reclamation harvests which in 1956 were valued at more than $951 million. Federal Reclamation facilities are capable of delivering irrigation water to more than 7½ million acres of land in the 17 Western States. Bureau of Reclamation photo.

wheat, lettuce, apples, pasture, barley, beans, oranges, corn, tomatoes, silage, cantaloupes, pears, peaches, and hops. Together, these crops account for 84 percent of the total crop value on Reclamation projects.

Crop	Gross crop value	Crop	Gross crop value
Cotton and cottonseed	$159, 044, 170	Dry edible beans	$27, 735, 480
Alfalfa hay	121, 820, 769	Oranges	20, 993, 213
Sugar beets	[1] 88, 218, 287	Corn	20, 428, 856
Potatoes	69, 387, 647	Tomatoes	20, 258, 242
Grapes	40, 682, 339	Silage	14, 323, 757
Wheat	34, 618, 601	Cantaloupes	13, 311, 360
Lettuce	32, 555, 177	Pears	12, 605, 033
Apples	30, 536, 925	Peaches	11, 736, 398
Pasture	30, 122, 072	Alfalfa seed	11, 820, 792
Barley	29, 985, 079	Hops	10, 062, 880

[1] Includes value of tops and sugar program payments.

Region 1, with 2,265,209 acres of irrigated lands, the largest in irrigated area of the seven Bureau Regions, produced crops valued at $269 million. This Region contains 35 percent of the irrigated lands and accounted for 28 percent of the total value of crops produced on all Reclamation projects in 1956. Region 3, with less than half as much irrigated land as Region 1, produced crops valued at $233 million, or 24 percent of the total production from all Federal projects during the same year. Comparative data for Regions follow:

Region	Irrigated acres		Gross crop value	
	Acres	Percent	Dollars	Percent
1	2, 265, 209	35. 4	268, 975, 631	28. 2
2	905, 322	14. 1	226, 182, 968	23. 8
3	907, 245	14. 2	233, 139, 732	24. 5
4	566, 670	8. 9	42, 529, 597	4. 5
5	301, 050	4. 7	56, 801, 792	6. 0
6	462, 004	7. 2	23, 382, 817	2. 5
7	992, 643	15. 5	100, 611, 119	10. 5
Total	6, 400, 143	100. 0	951, 623, 656	100. 0

TABLE 1.—*Irrigation and gross crop value data by States*

Region, project, division or reporting entity	State	Full irrigation service lands				Supplemental irrigation service lands
		Irrigable area for service	Irrigated area	Gross crop value		Irrigable area for service
				Total	Per irrigated acre	
Region 1		*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*
Arnold	Oregon	4, 292	2, 891	119, 639	41. 38	
Avondale	Idaho	927	383	20, 667	53. 96	
Baker	Oregon					7, 312
Bitter Root	Montana	16, 665	16, 340	588, 779	36. 03	
Boise (Idaho-Oregon):						
Arrowrock Division:						
Big Bend Irrigation District	Oregon	1, 724	1, 450	84, 771	58. 46	
Boise-Kuna Irrigation District	Idaho	48, 660	45, 110	3, 821, 942	84. 72	
Nampa and Meridian Irrigation District.	do	40, 265	35, 341	3, 001, 401	84. 93	
New York Irrigation District	do	17, 826	14, 170	708, 934	50. 03	
Settlers Irrigation District	do	518	500	47, 472	94. 94	
Wilder Irrigation District	do	56, 563	50, 085	7, 087, 384	141. 51	
Totals, Arrowrock Division		165, 556	146, 656	14, 751, 904	100. 59	
Payette Division:						
Black Canyon Irrigation District, Unit 1.	Idaho	6, 894	6, 173	1, 187, 870	192. 43	
Black Canyon Irrigation District, Unit 2.	do	51, 764	48, 848	3, 346, 237	68. 50	
Totals, Payette Division		58, 658	55, 021	4, 534, 107	82. 41	
Special and Warren Act Contractors:						
Ballantyne Ditch Co	Idaho					780
Boise Valley Irrigation Ditch Co.	do					2, 729
Capitol View Irrigation District.	do					515
Emmett Irrigation District	do					22, 269
Farmers Cooperative Irrigation District.	do					15, 500
Farmers Union Ditch Co	do					8, 200
Nampa and Meridian Irrigation District.	do					26, 188
New Dry Creek Ditch Co	do					2, 720
Pioneer Irrigation District	do					34, 050
Riverside Irrigation District	do					9, 573
Settlers Irrigation District	do					10, 115
South Boise Mutual Irrigation District.	do					745
Totals, Special and Warren Act Contractors.						133, 384
Totals, Boise project		224, 214	201, 677	19, 286, 011	95. 63	133, 384
Burnt River	Oregon					15, 230
Columbia Basin:						
East Columbia Basin Irrigation District.	Washington	111, 726	70, 653	10, 314, 053	145. 98	
Quincy-Columbia Basin Irrigation District.	do	121, 933	73, 286	9, 165, 440	125. 06	
South Columbia Basin Irrigation District.	do	72, 028	30, 849	2, 933, 588	95. 10	
Totals, Columbia Basin project.		305, 687	174, 788	22, 413, 081	128. 23	
Crescent Lake Dam	Oregon	6, 831	6, 178	297, 595	48. 17	
Dalton Gardens	Idaho	944	396	31, 922	80. 61	
Deschutes:						
Central Oregon Irrigation District.	Oregon					46, 620
Crook County Improvement District No. 1.	do					2, 520
North Unit Irrigation District	do	50, 000	46, 951	6, 014, 045	128. 09	
Totals, Deschutes project		50, 000	46, 951	6, 014, 045	128. 09	49, 140
Frenchtown	Montana	4, 810	3, 802	217, 039	57. 09	
Grants Pass	Oregon	10, 309	7, 378	910, 119	123. 36	
Lewiston Orchards	Idaho	3, 589	2, 085	447, 624	214. 69	

for each project and reporting organization, 1956

Supplemental irrigation service lands—Continued			Temporary irrigation service lands				Total			
Irrigated area	Gross crop value		Irrigable area for service	Irrigated area	Gross crop value		Irrigable area for service	Irrigated area	Gross crop value	
	Total	Per irrigated acre			Total	Per irrigated acre			Total	Per irrigated acre
Acres	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*
--------	--------	--------	--------	--------	--------	--------	4, 292	2, 891	119, 639	41. 38
--------	--------	--------	--------	--------	--------	--------	927	383	20, 667	53. 96
7, 305	375, 876	51. 45	--------	--------	--------	--------	7, 312	7, 305	375, 876	51. 45
--------	--------	--------	--------	--------	--------	--------	16, 665	16, 340	588, 779	36. 03
--------	--------	--------	--------	--------	--------	--------	1, 724	1, 450	84, 771	58. 46
--------	--------	--------	--------	--------	--------	--------	48, 660	45, 110	3, 821, 942	84. 72
--------	--------	--------	--------	--------	--------	--------	40, 265	35, 341	3, 001, 401	84. 93
--------	--------	--------	--------	--------	--------	--------	17, 826	14, 170	708, 934	50. 03
--------	--------	--------	--------	--------	--------	--------	518	500	47, 472	94. 94
--------	--------	--------	--------	--------	--------	--------	56, 563	50, 085	7, 087, 384	141. 51
--------	--------	--------	--------	--------	--------	--------	165, 556	146, 656	14, 751, 904	100. 59
--------	--------	--------	--------	--------	--------	--------	6, 894	6, 173	1, 187, 870	192. 43
--------	--------	--------	--------	--------	--------	--------	51, 764	48, 848	3, 346, 237	68. 50
--------	--------	--------	--------	--------	--------	--------	58, 658	55, 021	4, 534, 107	82. 41
687	62, 030	90. 29	--------	--------	--------	--------	780	687	62, 030	90. 29
2, 300	176, 725	76. 84	--------	--------	--------	--------	2, 729	2, 300	176, 725	76. 84
435	26, 536	61. 00	--------	--------	--------	--------	515	435	26, 536	61. 00
20, 594	3, 318, 074	161. 12	--------	--------	--------	--------	22, 269	20, 594	3, 318, 074	161. 12
13, 750	2, 078, 787	151. 18	--------	--------	--------	--------	15, 500	13, 750	2, 078, 787	151. 18
7, 700	578, 330	75. 11	--------	--------	--------	--------	8, 200	7, 700	578, 330	75. 11
24, 600	1, 912, 162	77. 73	--------	--------	--------	--------	26, 188	24, 600	1, 912, 162	77. 73
2, 104	147, 123	69. 93	--------	--------	--------	--------	2, 720	2, 104	147, 123	69. 93
32, 950	4, 110, 832	124. 76	--------	--------	--------	--------	34, 050	32, 950	4, 110, 832	124. 76
8, 623	1, 577, 114	182. 90	--------	--------	--------	--------	9, 573	8, 623	1, 577, 114	182. 90
9, 442	798, 288	84. 55	--------	--------	--------	--------	10, 115	9, 442	798, 288	84. 55
620	27, 888	44. 98	--------	--------	--------	--------	745	620	27, 888	44. 98
123, 805	14, 813, 889	119. 66	--------	--------	--------	--------	133, 384	123, 805	14, 813, 889	119. 66
123, 805	14, 813, 889	119. 66	--------	--------	--------	--------	357, 598	325, 482	34, 099, 900	104. 77
15, 115	649, 568	42. 98	--------	--------	--------	--------	15, 230	15, 115	649, 568	42. 98
--------	--------	--------	--------	--------	--------	--------	111, 726	70, 653	10, 314, 053	145. 98
--------	--------	--------	--------	--------	--------	--------	121, 933	73, 286	9, 165, 440	125. 06
--------	--------	--------	--------	--------	--------	--------	72, 028	30, 849	2, 933, 588	95. 10
--------	--------	--------	--------	--------	--------	--------	305, 687	174, 788	22, 413, 081	128. 23
--------	--------	--------	--------	--------	--------	--------	6, 831	6, 178	297, 595	48. 17
--------	--------	--------	--------	--------	--------	--------	944	396	31, 922	80. 61
43, 587	3, 136, 553	71. 96	--------	--------	--------	--------	46, 620	43, 587	3, 136, 553	71. 96
2, 414	292, 760	121. 28	--------	--------	--------	--------	2, 520	2, 414	292, 760	121. 28
--------	--------	--------	[1] 819	819	58, 759	71. 74	[1] 50, 819	47, 770	6, 072, 804	127. 13
46, 001	3, 429, 313	74. 55	[1] 819	819	58, 759	71. 74	[1] 99, 959	93, 771	9, 502, 117	101. 33
--------	--------	--------	--------	--------	--------	--------	4, 810	3, 802	217, 039	57. 09
--------	--------	--------	--------	--------	--------	--------	10, 309	7, 378	910, 119	123. 36
--------	--------	--------	--------	--------	--------	--------	3, 589	2, 085	447, 624	214. 69

TABLE 1.—*Irrigation and gross crop value data by States*

Region, project, division or reporting entity	State	Full irrigation service lands				Supplemental irrigation service lands
		Irrigable area for service	Irrigated area	Gross crop value		Irrigable area for service
				Total	Per irrigated acre	
Region 1—Continued						
Minidoka:		*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*
American Falls Reservoir District No. 2.	Idaho-Wyoming	98, 462	82, 346	5, 847, 019	71. 01	
Burley Irrigation District	do	47, 911	44, 209	3, 968, 702	89. 77	
Minidoka Irrigation District	do	71, 925	63, 381	5, 784, 079	91. 26	
North Side Pumping Division	do	26, 677	23, 511	2, 806, 788	119. 38	
Fremont-Madison Irrigation District.	do					112, 000
Special and Warren Act Contractors:						
Aberdeen-Springfield Canal Co	do					63, 000
Blackfoot Irrigation Co	do					18, 000
Burgess Canal and Irrigating Co	do					23, 000
Butte and Market Lake Canal Co.	do					20, 000
Corbett Slough Ditch Co	do					6, 200
Dilts Irrigation Co	do					800
Enterprise Canal Co., Ltd	do					5, 500
Enterprise Irrigation District	do					6, 000
Farmers Friend Irrigation Co	do					11, 000
Harrison Canal and Irrigation Co	do					14, 000
Hillsdale Irrigation District	do					21, 000
Idaho Irrigation District	do					37, 500
Individual Contractors (2)	do					290
Lenroot Canal Co	do					4, 450
Lowder Slough Canal Co., Ltd	do					1, 100
Martin Canal Co	do					1, 400
Milner Low Lift Irrigation District.	do					12, 444
New Sweden Irrigation District	do					26, 500
North Side Canal Co., Ltd	do					165, 000
Osgood Canal Co	do					7, 000
Owners Mutual Irrigation Co	do					980
People's Canal and Irrigation Co	do					20, 500
Poplar Irrigation District	do					900
Progressive Irrigation District	do					33, 000
Reid Canal Co	do					5, 400
Rudy Irrigation Canal Co	do					5, 800
Snake River Valley Irrigation District.	do					23, 000
Sunnydell Irrigation District	do					4, 000
Trego Ditch Co	do					1, 900
Twin Falls Canal Co	do					205, 000
Woodville Canal Co	do					3, 500
Totals, Special and Warren Act Contractors.						748, 164
Leased Lands						
Totals, Minidoka project		244, 975	213, 447	18, 406, 588	86. 23	860. 164
Missoula Valley	Montana	977	768	29, 093	37. 88	
Ochoco	Oregon	8, 500	8, 333	651, 145	78. 14	
Okanogan	Washington	5, 307	3, 972	650, 545	163. 78	
Owyhee Idaho-Oregon:						
North Division:						
Advancement Irrigation District.	Oregon	700	543	107, 416	197. 82	
Bench Irrigation District	do	2, 319	2, 249	646, 812	287. 60	
Crystal Irrigation District	do	1, 280	1, 206	330, 242	273. 83	
Ontario-Nyssa Irrigation District.	do	5, 831	5, 602	1, 363, 364	243. 37	
Owyhee Irrigation District	do	49, 583	46, 640	5, 397, 703	115. 73	
Payette-Oregon Slope Irrigation District.	do	4, 699	4, 402	1, 203, 760	273. 46	
Slide Irrigation District	do	1, 144	1, 079	201, 656	186. 89	
Totals, North Division		65, 556	61, 721	9, 250, 953	149. 88	

for each project and reporting organization, 1956—Continued

Supplemental irrigation service lands—Continued			Temporary irrigation service lands				Total			
Irrigated area	Gross crop value		Irrigable area for service	Irrigated area	Gross crop value		Irrigable area for service	Irrigated area	Gross crop value	
	Total	Per irrigated acre			Total	Per irrigated acre			Total	Per irrigated acre
Acres	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*
--------	--------	--------	--------	--------	--------	--------	98, 462	82, 346	5, 847, 019	71. 01
--------	--------	--------	--------	--------	--------	--------	47, 911	44, 209	3, 968, 702	89. 77
--------	--------	--------	--------	--------	--------	--------	71, 925	63, 381	5, 784, 079	91. 26
--------	--------	--------	--------	--------	--------	--------	26, 677	23, 511	2, 806, 788	119. 38
104, 164	10, 170, 867	97. 64	--------	--------	--------	--------	112, 000	104, 164	10, 170, 867	97. 64
49, 806	3, 957, 463	79. 46	--------	--------	--------	--------	63, 000	49, 806	3, 957, 463	79. 46
15, 000	1, 125, 158	75. 01	--------	--------	--------	--------	18, 000	15, 000	1, 125, 158	75. 01
22, 690	2, 264, 997	99. 82	--------	--------	--------	--------	23, 000	22, 690	2, 264, 997	99. 82
18, 500	1, 404, 605	75. 92	--------	--------	--------	--------	20, 000	18, 500	1, 404, 605	75. 92
6, 000	461, 034	76. 84	--------	--------	--------	--------	6, 200	6, 000	461, 034	76. 84
800	49, 394	61. 74	--------	--------	--------	--------	800	800	49, 394	61. 74
5, 000	383, 266	76. 65	--------	--------	--------	--------	5, 500	5, 000	383, 266	76. 65
5, 885	642, 613	109. 20	--------	--------	--------	--------	6, 000	5, 885	642, 613	109. 20
10, 750	993, 607	92. 43	--------	--------	--------	--------	11, 000	10, 750	993, 607	92. 43
13, 000	950, 622	73. 12	--------	--------	--------	--------	14, 000	13, 000	950, 622	73. 12
20, 500	1, 657, 059	80. 83	--------	--------	--------	--------	21, 000	20, 500	1, 657, 059	80. 83
35, 940	2, 691, 294	74. 88	--------	--------	--------	--------	37, 500	35, 940	2, 691, 294	74. 88
283	26, 102	92. 23	--------	--------	--------	--------	290	283	26, 102	92. 23
4, 200	265, 341	63. 18	--------	--------	--------	--------	4, 450	4, 200	265, 341	63. 18
1, 100	70, 016	63. 65	--------	--------	--------	--------	1, 100	1, 100	70, 016	63. 65
1, 320	98, 179	74. 38	--------	--------	--------	--------	1, 400	1, 320	98, 179	74. 38
11, 560	1, 106, 526	95. 72	--------	--------	--------	--------	12, 444	11, 560	1, 106, 526	95. 72
26, 000	2, 286, 850	87. 96	--------	--------	--------	--------	26, 500	26, 000	2, 286, 850	87. 96
161, 480	11, 947, 880	73. 99	--------	--------	--------	--------	165, 000	161, 480	11, 947, 880	73. 99
6, 550	715, 569	109. 25	--------	--------	--------	--------	7, 000	6, 550	715, 569	109. 25
880	79. 944	90. 85	--------	--------	--------	--------	980	880	79, 944	90. 85
20, 000	1, 477, 288	73. 86	--------	--------	--------	--------	20, 500	20, 000	1, 477, 288	73. 86
870	66, 078	75. 95	--------	--------	--------	--------	900	870	66, 078	75. 95
31, 655	2, 420, 779	76. 47	--------	--------	--------	--------	33, 000	31, 655	2, 420, 779	76. 47
5, 300	490, 406	92. 53	--------	--------	--------	--------	5, 400	5, 300	490, 406	92. 53
5, 500	426, 034	77. 46	--------	--------	--------	--------	5, 800	5, 500	426, 034	77. 46
21, 280	1, 559, 184	73. 27	--------	--------	--------	--------	23, 000	21, 280	1, 559, 184	73. 27
3, 800	235, 171	61. 89	--------	--------	--------	--------	4, 000	3, 800	235, 171	61. 89
1, 895	147, 632	77. 91	--------	--------	--------	--------	1, 900	1, 895	147, 632	77. 91
193, 400	16, 469, 434	85. 16	--------	--------	--------	--------	205, 000	193, 400	16, 469, 434	85. 16
3, 025	308, 765	102. 07	--------	--------	--------	--------	3, 500	3, 025	308, 765	102. 07
703, 969	56, 778, 290	80. 65	--------	--------	--------	--------	748, 164	703, 969	56, 778, 290	80. 65
--------	--------	--------	509	509	50, 824	99. 85	509	509	50, 824	99. 85
808, 133	66, 949, 157	82. 84	509	509	50, 824	99. 85	1, 105, 648	1, 022, 089	85, 406, 569	83. 56
--------	--------	--------	--------	--------	--------	--------	977	768	29, 093	37. 88
--------	--------	--------	--------	--------	--------	--------	8, 500	8, 333	651, 145	78. 14
--------	--------	--------	--------	--------	--------	--------	5. 307	3, 972	650, 545	163. 78
--------	--------	--------	--------	--------	--------	--------	700	543	107, 416	197. 82
--------	--------	--------	--------	--------	--------	--------	2, 319	2, 249	646, 812	287. 60
--------	--------	--------	--------	--------	--------	--------	1, 280	1, 206	330, 242	273. 83
--------	--------	--------	--------	--------	--------	--------	5, 831	5, 602	1, 363, 364	243. 37
--------	--------	--------	--------	--------	--------	--------	49, 583	46, 640	5, 397, 703	115. 73
--------	--------	--------	--------	--------	--------	--------	4, 699	4, 402	1, 203, 760	273. 46
--------	--------	--------	--------	--------	--------	--------	1, 144	1, 079	201, 656	186. 89
--------	--------	--------	--------	--------	--------	--------	65, 556	61, 721	9, 250, 953	149. 88

TABLE 1.—*Irrigation and gross crop value data by States*

Region, project, division or reporting entity	State	Full irrigation service lands				Supplemental irrigation service lands
		Irrigable area for service	Irrigated area	Gross crop value		Irrigable area for service
				Total	Per irrigated acre	
Region 1—Continued						
Owyhee Idaho-Oregon—Continued						
South Division:		*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*
Gem Irrigation District	Idaho	33, 454	31, 286	3, 480, 616	111. 25	
Ridgeview Irrigation District	Oregon	6, 159	5, 973	704, 124	117. 88	
Totals, South Division		39, 613	37, 259	4, 184, 740	112. 31	
Owyhee Ditch Company	Oregon					13, 800
Totals, Owyhee project		105, 169	98, 980	13, 435, 693	135. 74	13, 800
Rathdrum Prairie:						
Hayden Lake Unit	Idaho	1, 097	546	51, 592	94. 49	
Post Falls Unit	do	3, 195	2, 942	272, 066	92. 48	
Totals, Rathdrum Prairie project.		4, 292	3, 488	323, 658	92. 79	
Rogue River Basin:						
Medford Irrigation District	Oregon					9, 220
Rogue River Valley Irrigation District.	do					4, 900
Totals, Rogue River Basin project.						14, 120
Umatilla:						
East Division:						
Hermiston Irrigation District	Oregon	11, 000	6, 529	338, 706	51. 88	
South Division:						
Stanfield Irrigation District	do					6, 000
Westland Irrigation District	do					8, 229
West Division:						
West Extension Irrigation District.	do	7, 033	5, 594	289, 891	51. 82	
Totals, Umatilla project		18, 033	12, 123	628. 597	51. 85	14, 229
Vale	Oregon	32, 000	31, 594	2, 192, 167	69. 39	
Yakima:						
Kennewick Division	Washington	4, 637	2, 237	323, 160	144. 46	
Kittitas Division	do	57, 400	54, 334	2, 719, 945	50. 06	
Roza Division	do	72, 730	66, 508	14, 677, 778	220. 69	
Sunnyside Division:						
Grandview Irrigation District	do	3, 941	2, 986	811, 941	271. 92	
Granger Irrigation District	do	1, 600	1, 366	196, 609	143. 93	
Outlook Irrigation District	do	4, 741	4, 376	819, 228	187. 21	
Prosser Irrigation District	do	2, 155	1, 661	253, 523	152. 63	
Snipes Mountain Irrigation District.	do	1, 915	1, 485	229, 375	154. 46	
Sunnyside Irrigation District	do	4, 630	3, 166	343, 311	108. 44	
Sunnyside Valley Irrigation District.	do	84, 312	64, 927	13, 332, 908	205. 35	
Totals, Sunnyside Division		103, 294	79, 967	15, 986, 895	199. 92	
Tieton Division	Washington	27, 271	24, 084	17, 618, 273	731. 53	
Special and Warren Act Contractors:						
Broadway Irrigation Co	do					350
Cascade Irrigation District	do					12, 710
City of Yakima (Urban lots)	do					2, 380
Moxee Sub "A"	do					345
Naches-Selah Irrigation District	do					10, 000
Selah-Moxee Irrigation District	do					4, 600
Small Warren Act Contractors	do					104
Terrace Heights Irrigation District.	do					565
Union Gap Irrigation District	do					3, 407
Wapato Irrigation District	do					136, 000
West Side Irrigating Co	do					7, 000
Yakima Valley Canal Co	do					4, 300
Totals, Special and Warren Act Contractors.						181, 761
Totals, Yakima project		265. 332	227, 130	51, 326, 051	225. 98	181, 761
Totals, Region 1		1, 312, 853	1, 062, 704	137, 990, 058	129. 85	1, 289, 140

for each project and reporting organization, 1956—Continued

Supplemental irrigation service lands—Continued			Temporary irrigation service lands					Total		
Irrigated area	Gross crop value		Irrigable area for service	Irrigated area	Gross crop value		Irrigable area for service	Irrigated area	Gross crop value	
	Total	Per irrigated acre			Total	Per irrigated acre			Total	Per irrigated acre
Acres	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*
--------	--------	--------	--------	--------	--------	--------	33,454	31,286	3,480,616	111.25
--------	--------	--------	--------	--------	--------	--------	6,159	5,973	704,124	117.88
--------	--------	--------	--------	--------	--------	--------	39,613	37,259	4,184,740	112.31
12,860	3,436,099	267.19	--------	--------	--------	--------	13,800	12,860	3,436,099	267.19
12,860	3,436,099	267.19	--------	--------	--------	--------	118,969	111,840	16,871,792	150.86
--------	--------	--------	--------	--------	--------	--------	1,097	546	51,592	94.49
--------	--------	--------	--------	--------	--------	--------	3,196	2,942	272,066	92.48
--------	--------	--------	--------	--------	--------	--------	4,292	3,488	323,658	92.79
8,139	2,975,772	365.62	--------	--------	--------	--------	9,220	8,139	2,975,772	365.62
4,670	1,434,360	307.14	--------	--------	--------	--------	4,900	4,670	1,434,360	307.14
12,809	4,410,132	344.30	--------	--------	--------	--------	14,120	12,809	4,410,132	344.30
--------	--------	--------	--------	--------	--------	--------	11,000	6,529	338,706	51.88
5,207	678,766	130.36	--------	--------	--------	--------	6,000	5,207	678,766	130.36
5,715	612,879	107.24	--------	--------	--------	--------	8,229	5,715	612,879	107.24
--------	--------	--------	536	503	78,273	155.61	7,569	6,097	368,164	60.38
10,922	1,291,645	118.26	536	503	78,273	155.61	32,798	23,548	1,998,515	84.87
--------	--------	--------	--------	--------	--------	--------	32,000	31,594	2,192,167	69.39
--------	--------	--------	--------	--------	--------	--------	4,637	2,237	323,160	144.46
--------	--------	--------	--------	--------	--------	--------	57,400	54,334	2,719,945	50.06
--------	--------	--------	--------	--------	--------	--------	72,730	66,508	14,677,778	220.69
--------	--------	--------	--------	--------	--------	--------	3,941	2,986	811,941	271.92
--------	--------	--------	--------	--------	--------	--------	1,600	1,366	196,609	143.93
--------	--------	--------	--------	--------	--------	--------	4,741	4,376	819,228	187.21
--------	--------	--------	--------	--------	--------	--------	2,155	1,661	253,523	152.63
--------	--------	--------	--------	--------	--------	--------	1,915	1,485	229,375	154.46
--------	--------	--------	--------	--------	--------	--------	4,630	3,166	343,311	108.44
--------	--------	--------	240	194	27,720	142.89	84,552	65,121	13,360,628	205.17
--------	--------	--------	240	194	27,720	142.89	103,534	80,161	16,014,615	199.78
--------	--------	--------	--------	--------	--------	--------	27,271	24,084	17,618,273	731.53
235	24,559	104.51	--------	--------	--------	--------	350	235	24,559	104.51
12,480	851,450	68.23	--------	--------	--------	--------	12,710	12,480	851,450	68.23
--------	--------	--------					2,380	--------	--------	--------
345	157,040	455.19	--------	--------	--------	--------	345	345	157,040	455.19
9,760	7,364,909	754.60	--------	--------	--------	--------	10,000	9,760	7,364,909	754.60
4,470	1,599,915	357.92	--------	--------	--------	--------	4,600	4,470	1,599,915	357.92
94	5,908	62.85	--------	--------	--------	--------	104	94	5,908	62.85
465	186,008	400.02	--------	--------	--------	--------	565	465	186,008	400.02
2,950	1,718,430	582.52	--------	--------	--------	--------	3,407	2,950	1,718,430	582.52
123,421	21,155,118	171.41	--------	--------	--------	--------	136,000	123,421	21,155,118	171.41
5,510	344,745	62.57	--------	--------	--------	--------	7,000	5,510	344,745	62.57
3,800	2,006,236	527.96	--------	--------	--------	--------	4,300	3,800	2,006,236	527.96
163,530	35,414,318	216.56	--------	--------	--------	--------	181,761	163,530	35,414,318	216.56
163,530	35,414,318	216.56	240	194	27,720	142.89	447,333	390,854	86,768,089	222.00
1,200,480	130,769,997	108.93	2,104	2,025	215,576	106.46	2,604,097	2,265,209	268,975,631	118.74

TABLE 1.—*Irrigation and gross crop value data by States*

Region, project, division or reporting entity	State	Full irrigation service lands				Supplemental irrigation service lands
		Irrigable area for service	Irrigated area	Gross crop value		
				Total	Per irrigated acre	Irrigable area for service
Region 2						
Cachuma:		*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*
Goleta, Carpinteria, and Montecito County Water Districts.	California					26, 450
Summerland County Water District.	do	500	61			
Totals, Cachuma project		500	61			26, 450
Central Valley:						
Contra Costa Canal:						
Contra Costa County Water District.	California					7, 297
Delta-Mendota Canal and San Joaquin River:						
Borland Water District[2]	do					5, 785
Broadview Water District	do					9, 300
Columbia Canal Co.[2]	do					464
Crows Landing Naval Base[3]	do					748
Davis Water District	do	1, 990	910	136, 294	149. 77	
Del Puerto Water District	do	3, 624	3, 178	1, 601, 179	503. 83	
Eagle Field Water Users Association.	do					1, 441
Foothill Water District	do	1, 967	1, 831	315, 344	172. 23	
Fresno Slough Water District	do					1, 341
Hospital Water District	do	7, 621	7, 238	3, 159, 575	436. 53	
Melvin D. Hughes	do					50
James Irrigation District	do					24, 410
Kern Canon Water District	do	2, 950	2, 665	865, 344	324. 71	
Laguna Water Association	do					
Mercy Springs Water District	do					
Mustang Water District	do					3, 712
Orestimba Water District	do	4, 765	4, 605	1, 197, 764	260. 10	
Oro Loma Water District	do					1, 128
Panoche Water District	do					38, 240
Patterson Water District	do					14, 300
Plain View Water District	do	5, 419	4, 844	1, 440, 457	297. 37	
Quinto Water District	do					2, 173
Reclamation District No. 1606	do					115
Romero Water District	do					1, 323
Salado Water District	do	2, 786	2, 773	845, 214	304. 80	
San Luis Water District	do					45, 755
Sunflower Water District	do	2, 671	2, 579	861, 886	334. 19	
Traction Ranch (Frank Arcelus).	do					2, 859
Tranquillity Irrigation District	do					9, 527
West Stanislaus Irrigation District.	do					21, 532
Widren Water Users Association.	do					795
Lands Outside of Districts	do					
Totals, Delta-Mendota Canal and San Joaquin River.		33, 793	30, 623	10, 423, 057	340. 37	184, 998
Friant-Kern Canal:						
Cloer Community Services District.	California					
Cottonwood Ditch Association	do					
Delano-Earlimart Irrigation District.	do					53, 150
Exeter Irrigation District	do					13, 595
Homeland Reclamation District.	do					
International Water District	do					
Ivanhoe Irrigation District	do					10, 358
Kings County Water District	do					
Lewis Creek Water District	do					
Lindmore Irrigation District	do					26, 627
Lindsay-Strathmore Irrigation District.	do					13. 984
Lovell Community Services trict.[2]	do					3, 898

for each project and reporting organization, 1956—Continued

Supplemental irrigation service lands—Continued			Temporary irrigation service lands				Total			
Irrigated area	Gross crop value		Irrigable area for service	Irrigated area	Gross crop value		Irrigable area for service	Irrigated area	Gross crop value	
	Total	Per irrigated acre			Total	Per irrigated acre			Total	Per irrigated acre
Acres	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*
12,246	8,373,399	683.77	--------	--------	--------	--------	26,450	12,246	8,373,399	683.77
--------	--------	--------	--------	--------	--------	--------	500	61	--------	--------
12,246	8,373,399	683.77	--------	--------	--------	--------	26,950	12,307	8,373,399	680.38
6,302	2,213,403	351.22	--------	--------	--------	--------	7,297	6,302	2,213,403	351.22
--------	--------	--------	--------	--------	--------	--------	5,785	--------	--------	--------
7,361	1,325,061	180.01	--------	--------	--------	--------	9,300	7,361	1,325,061	180.01
--------	--------	--------	--------	--------	--------	--------	464	--------	--------	--------
--------	--------	--------	--------	--------	--------	--------	748	--------	--------	--------
--------	--------	--------	--------	--------	--------	--------	1,990	910	136,294	149.77
--------	--------	--------	--------	--------	--------	--------	3,624	3,178	1,601,179	503.83
1,304	292,464	224.28	--------	--------	--------	--------	1,441	1,304	292,464	224.28
--------	--------	--------	--------	--------	--------	--------	1,967	1,831	315,344	172.23
1,201	103,687	86.33	--------	--------	--------	--------	1,341	1,201	103,687	86.33
--------	--------	--------	--------	--------	--------	--------	7,621	7,238	3,159,575	436.53
50	1,485	29.70	--------	--------	--------	--------	50	50	1,485	29.70
18,940	3,701,360	195.43	--------	--------	--------	--------	24,410	18,940	3,701,360	195.43
--------	--------	--------	--------	--------	--------	--------	2,950	2,665	865,344	324.71
--------	--------	--------	131	125	6,634	53.07	131	125	6,634	53.07
--------	--------	--------	3,400	1,910	380,611	199.27	3,400	1,910	380,611	199.27
2,297	787,251	342.73	--------	--------	--------	--------	3,712	2,297	787,251	342.73
--------	--------	--------	--------	--------	--------	--------	4,765	4,605	1,197,764	260.10
865	190,344	220.05	--------	--------	--------	--------	1,128	865	190,344	220.05
32,199	7,365,292	228.74	--------	--------	--------	--------	38,240	32,199	7,365,292	228.74
13,800	3,875,303	280.82	--------	--------	--------	--------	14,300	13,800	3,875,303	280.82
--------	--------	--------	--------	--------	--------	--------	5,419	4,844	1,440,457	297.37
888	158,033	177.97	--------	--------	--------	--------	2,173	888	158,033	177.97
90	13,817	153.52	--------	--------	--------	--------	115	90	13,817	153.52
895	292,424	326.73	--------	--------	--------	--------	1,323	895	292,424	326.73
--------	--------	--------	--------	--------	--------	--------	2,786	2,773	845,214	304.80
19,895	4,165,637	209.38	--------	--------	--------	--------	45,755	19,895	4,165,637	209.38
--------	--------	--------	--------	--------	--------	--------	2,671	2,579	861,886	334.19
1,615	130,428	80.76	--------	--------	--------	--------	2,859	1,615	130,428	80.76
8,756	1,775,597	202.79	--------	--------	--------	--------	9,527	8,756	1,775.597	202.79
21,000	6,578,752	313.27	--------	--------	--------	--------	21,532	21,000	6,578.752	313.27
710	178,399	251.27	--------	--------	--------	--------	795	710	178,399	251.27
--------	--------	--------	711	711	168,211	236.58	711	711	168,211	236.58
131,866	30,935,334	234.60	4,242	2,746	555,456	202.28	223,033	165,235	41,913,847	253.66
--------	--------	--------	165	160	86,800	542.50	165	160	86,800	542.50
--------	--------	--------	452	435	111,474	256.26	452	435	111,474	256.26
48,103	25,419,533	528.44	--------	--------	--------	--------	53,150	48,103	25,419.533	528.44
10,975	5,273,425	480.49	--------	--------	--------	--------	13,595	10,975	5,273,425	480.49
--------	--------	--------	7,576	7,425	573,970	77.30	7,576	7,425	573,970	77.30
--------	--------	--------	483	470	27,025	57.50	483	470	27,025	57.50
9,353	4,679,695	500.34	--------	--------	--------	--------	10,358	9,353	4,679,695	500.34
--------	--------	--------	2,060	2,000	285,338	142.67	2,060	2,000	285,338	142.67
--------	--------	--------	1,217	394	151,941	385.64	1,217	394	151,941	385.64
24,497	10,297,324	420.35	--------	--------	--------	--------	26,627	24,497	10,297,324	420.35
10,260	6,610,160	644.27	--------	--------	--------	--------	13,984	10,260	6,610,160	644.27
--------	--------	--------	--------	--------	--------	--------	3,898	--------	--------	--------

TABLE 1.—*Irrigation and gross crop value data by States*

Region, project, division or reporting entity	State	Full irrigation service lands				Supplemental irrigation service lands
		Irrigable area for service	Irrigated area	Gross crop value		Irrigable area for service
				Total	Per irrigated acre	
Region 2—Continued						
Friant-Kern—Continued		*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*
Lower Tule River Irrigation District.	California					93, 688
Nunes Water District	do					
Orange Cove Irrigation District	do					26, 068
Porterville Irrigation District	do					15, 614
Rag Gulch Water District	do					
Saucelito Irrigation District	do					18, 661
South Lake Farms, Inc	do					
Southern San Joaquin Municipal Utility District.	do					59, 053
Stone Corral Irrigation District	do					5, 493
Terra Bella Irrigation District	do					12, 064
Tulare Irrigation District	do					69, 674
Tulare Lake Basin Water Storage District.	do					
Yettem-Seville Community Services District.	do					
Totals, Friant-Kern Canal						421, 927
Madera Canal:						
Chowchilla Water District	do					58, 615
Madera Irrigation District	do					106, 611
Totals, Madera Canal						165, 226
Sly Park Unit:						
El Dorado Irrigation District	do					10, 700
Totals, Central Valley Project.		33, 793	30, 623	10, 423, 057	340. 37	790, 148
Klamath, California-Oregon:						
Main Division	Oregon	39, 344	33, 505	3, 448, 629	102. 93	
Tule Lake Division	do	2, 088	2, 030	290, 007	142. 86	
Special and Warren Act Contractors.	do	81, 775	71, 955	6, 830, 093	94. 92	
Miscellaneous Rentals	do	4, 800	4, 000	463, 836	115. 96	
Lease Lands	do	12, 256	5, 242	250, 444	47. 78	
Totals, Oregon		140, 263	116, 732	11, 283, 009	96. 66	
Tule Lake Division	California	41, 686	40, 878	5, 273, 470	129. 01	
Tule Lake Sump	do	1, 190	1, 190	109, 071	91. 66	
Lower Klamath Lake Rentals	do	5, 722	5, 019	264, 926	52. 78	
Miscellaneous Rentals	do	244	244	17, 304	70. 92	
Lease Lands	do	29, 707	25, 414	1, 719, 465	67. 66	
Totals, California		78, 549	72, 745	7, 384, 236	101. 51	
Totals, Klamath project		218, 812	189, 477	18, 667, 245	98. 52	
Orland	California	19, 444	17, 260	1, 719, 384	99. 62	
Totals, Region 2		272, 549	237, 421	30, 809, 686	129. 77	816, 598
Region 3						
Boulder Canyon, Arizona-California-Nevada:						
All-American Canal System:						
Coachella Division	California	77, 287	53, 777	29, 859, 636	555. 25	
Imperial Division	do	530, 000	482, 374	93, 203, 180	193. 22	
Totals, Boulder Canyon project.		607, 287	536, 151	123, 062, 816	229. 53	

or each project and reporting organization, 1956—Continued

Supplemental irrigation service lands—Continued			Temporary irrigation service lands				Total			
Irrigated area	Gross crop value: Total	Gross crop value: Per irrigated acre	Irrigable area for service	Irrigated area	Gross crop value: Total	Gross crop value: Per irrigated acre	Irrigable area for service	Irrigated area	Gross crop value: Total	Gross crop value: Per irrigated acre
Acres	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*
75, 148	14, 563, 129	193. 79	--------	--------	--------	--------	93, 688	75, 148	14, 563, 129	193. 79
--------	--------	--------	1, 120	1, 085	115, 093	106. 08	1, 120	1, 085	115, 093	106. 08
16, 940	7, 319, 627	432. 09	--------	--------	--------	--------	26, 068	16, 940	7, 319, 627	432. 09
13, 591	3, 929, 660	289. 14	--------	--------	--------	--------	15, 614	13, 591	3, 929, 660	289. 14
--------	--------	--------	2, 164	1, 904	1, 265, 396	664. 60	2, 164	1, 904	1, 265, 396	664. 60
17, 174	5, 003, 348	291. 33	--------	--------	--------	--------	18, 661	17, 174	5, 003, 348	291. 33
--------	--------	--------	800	785	66, 000	84. 08	800	785	66, 000	84. 08
47, 035	18, 763, 590	398. 93	--------	--------	--------	--------	59, 053	47, 035	18, 763, 590	398. 93
4, 706	1, 354, 685	287. 86	--------	--------	--------	--------	5, 493	4, 706	1, 354, 685	287. 86
4, 400	2, 207, 389	501. 68	--------	--------	--------	--------	12, 064	4, 400	2, 207, 389	501. 68
59, 285	12, 284, 390	207. 21	--------	--------	--------	--------	69, 674	59, 285	12, 284, 390	207. 21
--------	--------	--------	16, 250	15, 925	1, 519, 894	95. 44	16, 250	15, 925	1, 519, 894	95. 44
--------	--------	--------	5, 277	3, 040	933, 764	307. 16	5, 277	3, 040	933, 764	307. 16
341, 467	117, 705, 955	344. 71	37, 564	33, 623	5, 136, 695	152. 77	459, 491	375, 090	122, 842, 650	327. 50
48, 811	7, 109, 219	145. 65	--------	--------	--------	--------	58, 615	48, 811	7, 109, 219	145. 65
86, 250	20, 309, 138	235. 47	--------	--------	--------	--------	106, 611	86, 250	20, 309, 138	235. 47
135, 061	27, 418, 357	203. 01	--------	--------	--------	--------	165, 226	135, 061	27, 418, 357	203. 01
4, 590	3, 034, 683	661. 15	--------	--------	--------	--------	10, 700	4, 590	3, 034, 683	661. 15
619, 286	181, 307, 732	292. 77	41, 806	36, 369	5, 692, 151	156. 51	865, 747	686, 278	197, 422, 940	287. 67
--------	--------	--------	--------	--------	--------	--------	39, 344	33, 505	3, 448, 629	102. 93
--------	--------	--------	--------	--------	--------	--------	2, 088	2, 030	290, 007	142. 86
--------	--------	--------	--------	--------	--------	--------	81, 775	71, 955	6, 830, 093	94. 92
--------	--------	--------	--------	--------	--------	--------	4, 800	4, 000	463, 836	115. 96
--------	--------	--------	--------	--------	--------	--------	12, 256	5, 242	250, 444	47. 78
--------	--------	--------	--------	--------	--------	--------	140, 263	116, 732	11, 283, 009	96. 66
--------	--------	--------	--------	--------	--------	--------	41, 686	40, 878	5, 273, 470	129. 01
--------	--------	--------	--------	--------	--------	--------	1, 190	1, 190	109, 071	91. 66
--------	--------	--------	--------	--------	--------	--------	5, 722	5, 019	264, 926	52. 78
--------	--------	--------	--------	--------	--------	--------	244	244	17, 304	70. 92
--------	--------	--------	--------	--------	--------	--------	29, 707	25, 414	1, 719, 465	67. 66
--------	--------	--------	--------	--------	--------	--------	78, 549	72, 745	7, 384, 236	101. 51
--------	--------	--------	--------	--------	--------	--------	218, 812	189, 477	18, 667, 245	98. 52
--------	--------	--------	--------	--------	--------	--------	19, 444	17, 260	1, 719, 384	99. 62
631, 532	189, 681, 131	300. 35	41, 806	36, 369	5, 692, 151	156. 51	1, 130, 953	905, 322	226, 182, 968	249. 84
--------	--------	--------	--------	--------	--------	--------	77, 287	53, 777	29, 859, 636	555. 25
--------	--------	--------	--------	--------	--------	--------	530, 000	482, 374	93, 203, 180	193. 22
--------	--------	--------	--------	--------	--------	--------	607, 287	536, 151	123, 062, 816	229. 53

TABLE 1.—*Irrigation and gross crop value data by States*

Region, project, division or reporting entity	State	Full irrigation service lands				Supplemental irrigation service lands
		Irrigable area for service	Irrigated area	Gross crop value		
				Total	Per irrigated acre	Irrigable area for service
Region 3—Continued						
Gila:		*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*
Wellton-Mohawk Division	Arizona	69, 300	34, 939	5, 197, 880	148. 77	----------
Yuma Mesa Division:						
North Gila unit	do	6, 715	6, 581	1, 947, 239	295. 89	----------
South Gila unit	do	1, 985	1, 985	207, 508	104. 54	----------
Yuma Mesa unit	do	19, 970	13, 473	1, 442, 701	107. 08	----------
Totals, Yuma Mesa Division.		28, 670	22, 039	3, 597, 448	163. 23	----------
Totals, Gila project		97, 970	56, 978	8, 795, 328	154. 36	----------
Salt River:						
Salt River Valley Water Users' Association.	Arizona	239, 581	177, 988	59, 203, 483	332. 63	----------
Special contractors:						
Fort McDowell Indian Reservation.	do	----------	----------	----------	----------	600
Peninsula-Horowitz Irrigation District.	do	----------	----------	----------	----------	2, 262
Pima Area Indians-Gila Crossing District.	do	----------	----------	----------	----------	2, 992
Pima Area Indians-Maricopa Colony District.	do	----------	----------	----------	----------	1, 080
Roosevelt Irrigation District	do	----------	----------	----------	----------	38, 014
Roosevelt Water Conservation District.	do	----------	----------	----------	----------	39, 425
Salt River Indian Reservation	do	----------	----------	----------	----------	9, 304
St. Johns Irrigation District	do	----------	----------	----------	----------	2, 031
Totals, special contractors		----------	----------	----------	----------	95, 708
Totals, Salt River project		239, 581	177, 988	59, 203, 483	332. 63	95, 708
Yuma, Arizona-California:						
Reservation Division:						
Bard unit	California	6, 867	5, 615	1, 170, 407	208. 44	----------
Indian unit	do	7, 743	3, 845	939, 360	244. 31	----------
Valley Division	Arizona	51, 936	46, 430	18, 886, 884	406. 78	----------
Totals, Yuma project		66, 546	55, 890	20, 996, 651	375. 68	----------
Yuma Auxiliary:						
Unit B Irrigation and Drainage District.	Arizona	3, 305	2, 489	677, 096	272. 04	----------
Warren Act Lands	do	118	108	44, 899	415. 73	----------
Totals, Yuma Auxiliary project.		3, 423	2, 597	721, 995	278. 01	----------
Totals, Region 3		1, 014, 807	829, 604	212, 780, 273	256. 48	95, 708
Region 4						
Eden	Wyoming	10, 070	8, 571	300, 659	35. 08	----------
Fruitgrowers Dam	Colorado	----------	----------	----------	----------	2, 662
Grand Valley:						
Garfield Gravity Division	do	23, 317	21, 508	1, 952, 695	90. 79	----------
Orchard Mesa Division	do	10, 027	7, 246	2, 073, 661	286. 18	----------
Mesa County Irrigation District and Palisade Irrigation District.	do	----------	----------	----------	----------	7, 730
Garfield Gravity Division—Leased Lands.	do	1, 421	77	6, 518	84. 65	----------
Totals, Grand Valley project		34, 765	28, 831	4, 032, 874	139. 88	7, 730
Humboldt	Nevada	----------	----------	----------	----------	40, 500
Hyrum	Utah	----------	----------	----------	----------	6, 800
Mancos	Colorado	----------	----------	----------	----------	8, 761
Moon Lake	Utah	----------	----------	----------	----------	75, 256

for each project and reporting organization, 1956—Continued

Supplemental irrigation service lands—Continued			Temporary irrigation service lands				Total			
Irrigated area	Gross crop value		Irrigable area for service	Irrigated area	Gross crop value		Irrigable area for service	Irrigated area	Gross crop value	
	Total	Per irrigated acre			Total	Per irrigated acre			Total	Per irrigated acre
Acres	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*
--------	--------	--------	--------	--------	--------	--------	69, 300	34, 939	5, 197, 880	148. 77
--------	--------	--------	--------	--------	--------	--------	6, 715	6, 581	1, 947, 239	295. 89
--------	--------	--------	--------	--------	--------	--------	1, 985	1, 985	207, 508	104. 54
--------	--------	--------	--------	--------	--------	--------	19, 970	13, 473	1, 442, 701	107. 08
--------	--------	--------	--------	--------	--------	--------	28, 670	22, 039	3, 597, 448	163. 23
--------	--------	--------	--------	--------	--------	--------	97, 970	56, 978	8, 795, 328	154. 36
--------	--------	--------	--------	--------	--------	--------	239, 581	177, 988	59, 203, 483	332. 63
276	9, 193	33. 31	--------	--------	--------	--------	600	276	9, 193	33. 31
2, 262	390, 329	172. 56	--------	--------	--------	--------	2, 262	2, 262	390, 329	172. 56
513	42, 336	82. 53	--------	--------	--------	--------	2, 992	513	42, 336	82. 53
1, 080	65, 160	60. 33	--------	--------	--------	--------	1, 080	1, 080	65, 160	60. 33
36, 193	7, 796, 264	215. 41	--------	--------	--------	--------	38, 014	36, 193	7, 796, 264	215. 41
29, 704	10, 406, 315	350. 33	--------	--------	--------	--------	39, 425	29, 704	10, 406, 315	350. 33
5, 633	1, 462, 562	259. 64	--------	--------	--------	--------	9, 304	5, 633	1, 462, 562	259. 64
1, 980	187, 300	94. 60	--------	--------	--------	--------	2, 031	1, 980	187, 300	94. 60
77, 641	20, 359, 459	262. 23	--------	--------	--------	--------	95, 708	77, 641	20, 359, 459	262. 23
77, 641	20, 359, 459	262. 23	--------	--------	--------	--------	335, 289	255, 629	79, 562, 942	311. 24
--------	--------	--------	--------	--------	--------	--------	6, 867	5, 615	1, 170, 407	208. 44
--------	--------	--------	--------	--------	--------	--------	7, 743	3, 845	939, 360	244. 31
--------	--------	--------	--------	--------	--------	--------	51, 936	46, 430	18, 886, 884	406. 78
--------	--------	--------	--------	--------	--------	--------	66, 546	55, 890	20, 996, 651	375. 68
--------	--------	--------	--------	--------	--------	--------	3, 305	2, 489	677, 096	272. 04
--------	--------	--------	--------	--------	--------	--------	118	108	44, 899	415. 73
--------	--------	--------	--------	--------	--------	--------	3, 423	2, 597	721, 995	278. 01
77, 641	20, 359, 459	262. 23	--------	--------	--------	--------	1, 110, 515	907, 245	233, 139, 732	256. 98
--------	--------	--------	--------	--------	--------	--------	10, 070	8, 571	300, 659	35. 08
1, 720	255, 004	148. 26	--------	--------	--------	--------	2, 662	1, 720	255, 004	148. 26
--------	--------	--------	--------	--------	--------	--------	23, 317	21, 508	1, 952, 695	90. 79
--------	--------	--------	--------	--------	--------	--------	10, 027	7, 246	2, 073, 661	286. 18
7, 730	1, 920, 319	248. 42	--------	--------	--------	--------	7, 730	7, 730	1, 920, 319	248. 42
--------	--------	--------	--------	--------	--------	--------	1, 421	77	6, 518	84. 65
7, 730	1, 920, 319	248. 42	--------	--------	--------	--------	42, 495	36, 561	5, 953, 193	162. 83
29, 795	1, 884, 092	63. 24	--------	--------	--------	--------	40, 500	29, 795	1, 884, 092	63. 24
5, 780	365, 898	63. 30	--------	--------	--------	--------	6, 800	5, 780	365, 898	63. 30
7, 220	323, 582	44. 82	--------	--------	--------	--------	8, 761	7, 220	323, 582	44. 82
54, 302	1, 173, 908	21. 62	--------	--------	--------	--------	75, 256	54, 302	1, 173, 908	21. 62

TABLE 1.—*Irrigation and gross crop value data by States*

Region, project, division or reporting entity	State	Full irrigation service lands				Supplemental irrigation service lands
		Irrigable area for service	Irrigated area	Gross crop value		Irrigable area for service
				Total	Per irrigated acre	
Region 4—Continued						
Newlands:		*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*
North Carson Division	Nevada	8, 126	5, 290	319, 876	60. 47	
South Carson Division	do	57, 166	44, 000	2, 281, 076	51. 84	
Truckee Division	do	7, 078	5, 473	348, 196	63. 62	
Totals, Newlands project		72, 370	54, 763	2, 949, 148	53. 85	
Newton	Utah					2, 200
Ogden River	do					22, 867
Paonia	Colorado	11, 653	8, 900	730, 790	82. 11	
Pine River	do					41, 193
Pine River Indian Irrigation	do					9, 666
Preston Bench	Idaho					4, 500
Provo River: Deer Creek Division	Utah					46, 609
Sanpete:						
Ephraim Division	do					7, 630
Spring City Division	do					6, 033
Totals, Sanpete project						13, 663
Scofield	Utah					15, 609
Strawberry Valley:						
Highline Division	do	17, 635	15, 700	845, 203	53. 83	
Spanish Fork Division	do					13, 693
Springville-Mapleton Division	do					8, 611
Totals, Strawberry Valley project.		17, 635	15, 700	845, 203	53. 83	22, 304
Truckee Storage	Nevada-California.					28, 977
Uncompahgre	Colorado	89, 090	73, 987	5, 671, 204	76. 65	
Weber River	Utah					109, 032
Totals, Region 4		235, 583	190, 752	14, 529, 878	76. 17	458. 329
Region 5						
W. C. Austin	Oklahoma	47, 809	39, 296	4, 967, 297	126. 41	
Balmorhea	Texas					10, 608
Carlsbad	New Mexico	25, 055	19, 606	4, 416, 796	225. 28	
Fort Sumner	do	6, 500	5, 366	522, 264	97. 33	
Middle Rio Grande	do	121, 680	53, 466	4, 845, 854	90. 63	
Rio Grande:						
Elephant Butte Irrigation District	do	102, 061	82, 110	22, 213, 161	270. 53	
El Paso County Water Improvement District No. 1.	Texas	75, 890	50, 245	14, 583, 282	290. 24	
Hudspeth County Conservation and Reclamation District No. 1.	do					[4] 18, 330
Totals, Rio Grande project		177, 951	132, 355	36, 796, 443	278. 01	[4] 18, 330
Tucumcari	New Mexico	42, 214	33, 140	2, 393, 249	72. 22	
Vermejo	do	7, 379	4, 941	204, 929	41. 48	
Totals, region 5		428, 588	288, 170	54, 146, 832	187. 90	28, 938
Region 6						
Belle Fourche	South Dakota	57, 182	53, 885	2, 480, 653	46. 04	
Buffalo Rapids:						
First Division	Montana	13, 903	12, 356	722, 535	58. 48	
Second Division	do	9, 422	8, 522	526, 960	61. 84	
Totals, Buffalo Rapids project		23, 325	20, 878	1, 249, 495	59. 85	
Buford-Trenton	North Dakota	10, 510	8, 946	516, 370	57. 72	
Huntley	Montana	32, 487	24, 426	1, 576, 052	64. 52	
Intake	do	881	737	18, 735	25. 42	

See footnotes at end of table.

for each project and reporting organization, 1956—Continued

Supplemental irrigation service lands—Continued			Temporary irrigation service lands				Total			
Irrigated area	Gross crop value		Irrigable area for service	Irrigated area	Gross crop value		Irrigable area for service	Irrigated area	Gross crop value	
	Total	Per irrigated acre			Total	Per irrigated acre			Total	Per irrigated acre
Acres	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*
--------	--------	--------	--------	--------	--------	--------	8,126	5,290	319,876	60.47
--------	--------	--------	--------	--------	--------	--------	57,166	44,000	2,281,076	51.84
--------	--------	--------	--------	--------	--------	--------	7,078	5,473	348,196	63.62
--------	--------	--------	--------	--------	--------	--------	72,370	54,763	2,949,148	53.85
2,116	122,469	57.88	--------	--------	--------	--------	2,200	2,116	122,469	57.88
15,869	1,906,267	120.13	--------	--------	--------	--------	22,867	15,869	1,906,267	120.13
--------	--------	--------	--------	--------	--------	--------	11,653	8,900	730,790	82.11
37,057	2,015,024	54.38	--------	--------	--------	--------	41,193	37,057	2,015,024	54.38
9,666	349,977	36.21	--------	--------	--------	--------	9,666	9,666	349,977	36.21
3,689	315.490	85.52	--------	--------	--------	--------	4,500	3,689	315,490	85.52
37,540	3,780,174	100.70	--------	--------	--------	--------	46,609	37,540	3,780,174	100.70
6,664	237,050	35.57	--------	--------	--------	--------	7,630	6,664	237,050	35.57
4,785	233,400	48.78	--------	--------	--------	--------	6,033	4,785	233,400	48.78
11,449	470,450	41.09	--------	--------	--------	--------	13,663	11,449	470.450	41.09
13,348	715,004	53.57	--------	--------	--------	--------	15,609	13,348	715,004	53.57
--------	--------	--------	--------	--------	--------	--------	17,635	15,700	845,203	53.83
13,290	1,069,868	80.50	4,107	4,026	301,775	74.96	17,800	17,316	1,371,643	79.21
7,934	561,866	70.82	--------	--------	--------	--------	8,611	7,934	561,866	70.82
21,224	1,631,734	76.88	4,107	4,026	301,775	74.96	44,046	40,950	2,778,712	67.86
22,446	1,664,202	74.14	--------	--------	--------	--------	28,977	22,446	1,664,202	74.14
--------	--------	--------	--------	--------	--------	--------	89,090	73,987	5,671,204	76.65
90,941	8.804.350	96.81	--------	--------	--------	--------	109,032	90,941	8.804.350	96.81
371,892	27,697,944	74.48	4,107	4,026	301.775	74.96	698,019	566,670	42,529.597	75.05
--------	--------	--------	--------	--------	--------	--------	47,809	39,296	4,967,297	126.41
7,700	1,179,506	153.18	--------	--------	--------	--------	10,608	7,700	1,179,506	153.18
--------	--------	--------	--------	--------	--------	--------	25,055	19,606	4,416,796	225.28
--------	--------	--------	--------	--------	--------	--------	6,500	5,366	522,264	97.33
--------	--------	--------	--------	--------	--------	--------	121,680	53,466	4,845,854	90.63
--------	--------	--------	--------	--------	--------	--------	102,061	82,110	22,213,161	270.53
--------	--------	--------	--------	--------	--------	--------	75,890	50,245	14,583,282	290.24
5,180	1,475,454	284.84	--------	--------	--------	--------	[4] 18,330	5,180	1,475,454	284.84
5,180	1,475,454	284.84	--------	--------	--------	--------	[5] 196,281	137,535	38,271,897	278.27
--------	--------	--------	--------	--------	--------	--------	42,214	33,140	2,393,249	72.22
--------	--------	--------	--------	--------	--------	--------	7,379	4,941	204,929	41.48
12,880	2,654,960	206.13	--------	--------	--------	--------	457,526	301,050	56,801,792	188.68
--------	--------	--------	--------	--------	--------	--------	57,182	53,885	2,480,653	46.04
--------	--------	--------	1,243	1,243	53,534	43.07	15,146	13,599	776,069	57.07
--------	--------	--------	950	950	46,150	48.58	10,372	9,472	573,110	60.51
--------	--------	--------	2,193	2,193	99,684	45.46	25,518	23,071	1,349,179	58.48
--------	--------	--------	--------	--------	--------	--------	10,510	8,946	516,370	57.72
--------	--------	--------	--------	--------	--------	--------	32,487	24,426	1,576,052	64.52
--------	--------	--------	--------	--------	--------	--------	881	737	18,735	25.42

TABLE 1.—*Irrigation and gross crop value data by States*

Region, project, division or reporting entity	State	Full irrigation service lands				Supplemental irrigation service lands
		Irrigable area for service	Irrigated area	Gross crop value		Irrigable area for service
				Total	Per irrigated acre	
Region 6—Continued						
		Acres	*Acres*	*Dollars*	*Dollars*	*Acres*
Lower Yellowstone:						
District No. 1	Montana	36, 866	32, 591	2, 327, 440	71. 41	
District No. 2	North Dakota	19, 405	16, 740	1, 109, 035	66. 25	
Totals, Lower Yellowstone project.		56, 271	49, 331	3, 436, 475	69. 66	
Milk River:						
Chinook Division	Montana	43, 484	27, 760	1, 643, 965	59. 22	
Dodson Pumping Unit	do	1, 147	961	52, 827	54. 97	
Fort Belknap Indian Reservation	do	7, 507	6, 411	111, 065	17. 32	
Glasgow Division	do	19, 407	13, 364	553, 506	41. 42	
Malta Division	do	53, 733	24, 867	1, 029, 785	41. 41	
Private Pumpers	do	6, 212	6, 002	383, 167	63. 84	
Totals, Milk River project		131, 490	79, 365	3, 774, 315	47. 56	
Missouri River Basin:						
Cheyenne Division: Angostura unit.	South Dakota	12, 154	10, 500	582, 655	55. 49	
Heart Division:						
Dickinson unit	North Dakota	338	338	18, 842	55. 75	
Heart Butte unit	do	2, 533	269	9, 886	36. 75	
North Dakota Pumping Division: Fort Clark unit.	do	2, 039	573	36, 217	63. 21	
Three Forks Division: Crow Creek Pump unit.	Montana	1, 542	897	47, 816	53. 31	
Yellowstone Division: Savage unit	do	2, 215	2, 072	84, 325	40. 70	
Rapid Valley	South Dakota					8, 900
Riverton:						
Midvale Irrigation District	Wyoming	47, 223	41, 324	1, 789, 470	43. 30	
Third Division	do	8, 585	7, 644	240, 679	31. 49	
Totals, Riverton project		55, 808	48, 968	2, 030, 149	41. 46	
Shoshone (Wyoming-Montana):						
Frannie Division	Wyoming	20, 083	10, 030	378, 169	37. 70	
Garland Division	do	35, 950	31, 788	2, 060, 904	64. 83	
Heart Mountain Division	do	25, 973	23, 192	1, 298, 099	55. 97	
Willwood Division	do	11, 590	9, 691	634, 125	65. 43	
Totals, Shoshone project		93, 596	74, 701	4, 371, 297	58. 52	
Sun River:						
Fort Shaw Division	Montana	10, 522	9, 809	245, 329	25. 01	
Greenfields Division	do	83, 502	57, 158	2, 217, 271	38. 79	
Totals, Sun River project		94, 024	66, 967	2, 462, 600	36. 77	
Totals, Region 6		576, 395	442, 853	22, 695, 882	51. 25	8, 900
Region 7						
Colorado-Big Thompson	Colorado					615, 000
Kendrick	Wyoming	22, 128	14, 167	569, 781	40. 22	
Mirage Flats	Nebraska	11, 657	11, 235	1, 122, 941	99. 95	
Missouri River Basin:						
Bostwick Division: Courtland unit	Kansas	10, 100	5, 347	404, 812	75. 71	
Superior-Courtland unit	Nebraska	21, 009	14, 567	1, 301, 399	89. 34	
Frenchman-Cambridge Division	do	22, 507	17, 265	1, 710, 144	99. 05	
Upper Republican Division: St. Francis unit.	Colorado-Kansas					750
North Platte (Nebraska-Wyoming):						
Gering-Fort Laramie Irrigation District.	Nebraska	54, 845	53, 302	6, 413, 400	120. 32	
Goshen Irrigation District	Wyoming	52, 484	51, 590	4, 399, 383	85. 28	
Northport Irrigation District	Nebraska	16, 170	13, 022	809, 940	62. 20	
Pathfinder Irrigation District	Nebraska-Wyoming.	[6] 102, 824	91, 342	7, 130, 566	78. 06	

See footnotes at end of table.

for each project and reporting organization, 1956—Continued

Supplemental irrigation service lands—Continued			Temporary irrigation service lands				Total			
Irrigated area	Gross crop value		Irrigable area for service	Irrigated area	Gross crop value		Irrigable area for service	Irrigated area	Gross crop value	
	Total	Per irrigated acre			Total	Per irrigated acre			Total	Per irrigated acre
Acres	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*
--------	--------	--------	974	974	54, 207	55. 65	37, 840	33, 565	2, 381, 647	70. 96
--------	--------	--------	73	73	4, 080	55. 89	19, 478	16, 813	1, 113, 115	66. 21
--------	--------	--------	1, 047	1, 047	58, 287	55. 67	57, 318	50, 378	3, 494, 762	69. 37
--------	--------	--------	--------	--------	--------	--------	43, 484	27, 760	1, 643, 965	59. 22
--------	--------	--------	--------	--------	--------	--------	1, 147	961	52, 827	54. 97
--------	--------	--------	--------	--------	--------	--------	7, 507	6, 411	111, 065	17. 32
--------	--------	--------	--------	--------	--------	--------	19, 407	13, 364	553, 506	41. 42
--------	--------	--------	--------	--------	--------	--------	53, 733	24, 867	1, 029, 785	41. 41
--------	--------	--------	--------	--------	--------	--------	6, 212	6, 002	383, 167	63. 84
--------	--------	--------	--------	--------	--------	--------	131, 490	79, 365	3, 774, 315	47. 56
--------	--------	--------	220	220	11, 920	54. 18	12, 374	10, 720	594, 575	55. 46
--------	--------	--------	--------	--------	--------	--------	338	338	18, 842	55. 75
--------	--------	--------	--------	--------	--------	--------	2, 533	269	9, 886	36. 75
--------	--------	--------	--------	--------	--------	--------	2, 039	573	36, 217	63. 21
--------	--------	--------	--------	--------	--------	--------	1, 542	897	47, 816	53. 31
--------	--------	--------	--------	--------	--------	--------	2, 215	2, 072	84, 325	40. 70
7, 310	241, 749	33. 07	--------	--------	--------	--------	8, 900	7, 310	241, 749	33. 07
--------	--------	--------	2, 183	2, 183	86, 343	39. 55	49, 406	43, 507	1, 875, 813	43. 12
--------	--------	--------	6, 198	6, 198	188, 952	30. 49	14, 783	13, 842	429, 631	31. 04
--------	--------	--------	8, 381	8, 381	275, 295	32. 85	64, 189	57, 349	2, 305, 444	40. 20
--------	--------	--------	--------	--------	--------	--------	20, 083	10, 030	378, 169	37. 70
--------	--------	--------	--------	--------	--------	--------	35, 950	31, 788	2, 060, 904	64. 83
--------	--------	--------	--------	--------	--------	--------	25, 973	23, 192	1, 298, 099	55. 97
--------	--------	--------	--------	--------	--------	--------	11, 590	9, 691	634, 125	65. 43
--------	--------	--------	--------	--------	--------	--------	93, 596	74, 701	4, 371, 297	58. 52
--------	--------	--------	--------	--------	--------	--------	10, 522	9, 809	245, 329	25. 01
--------	--------	--------	--------	--------	--------	--------	83, 502	57, 158	2, 217, 271	38. 79
--------	--------	--------	--------	--------	--------	--------	94, 024	66, 967	2, 462, 600	36. 77
7, 310	241, 749	33. 07	11, 841	11, 841	445, 186	37. 60	597, 136	462, 004	23, 382, 817	50. 61
615, 000	65, 518, 329	106. 53	--------	--------	--------	--------	615, 000	615, 000	65, 518, 329	106. 53
--------	--------	--------	--------	--------	--------	--------	22, 128	14, 167	569, 781	40. 22
--------	--------	--------	--------	--------	--------	--------	11, 657	11, 235	1, 122, 941	99. 95
--------	--------	--------	--------	--------	--------	--------	10, 100	5, 347	404, 812	75. 71
--------	--------	--------	--------	--------	--------	--------	21, 009	14. 567	1, 301, 399	89. 34
--------	--------	--------	--------	--------	--------	--------	22, 507	17, 265	1, 710, 144	99. 05
734	23, 536	32. 07	--------	--------	--------	--------	750	734	23, 536	32. 07
--------	--------	--------	--------	--------	--------	--------	54, 845	53, 302	6, 413, 400	120. 32
--------	--------	--------	--------	--------	--------	--------	52, 484	51, 590	4, 399, 383	85. 28
--------	--------	--------	--------	--------	--------	--------	16, 170	13, 022	809, 940	62. 20
--------	--------	--------	--------	--------	--------	--------	[6] 102, 824	91, 342	7, 130, 566	78. 06

TABLE 1.—*Irrigation and gross crop value data by States*

Region, project, division or reporting entity	State	Full irrigation service lands				Supplemental irrigation service lands
		Irrigable area for service	Irrigated area	Gross crop value		Irrigable area for service
				Total	Per irrigated acre	
Region 7—Continued						
North Platte—Continued						
Warren Act contractors:		*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*
Beerline Canal Company	Nebraska					1,003
Brown's Creek Irrigation District.	do					6,054
Central Irrigation District	do					2,127
Chimney Rock Irrigation District.	do					5,636
Farmers' Irrigation District	do					63,324
Gering Irrigation District	do					14,254
Lingle Water Users and Hill District.	Wyoming					15,367
Rock Ranch Ditch Co	do					950
Leased and Water Rental Lands	Nebraska					
Totals, North Platte project		226,323	209,256	18,753,289	89.62	108,715
Totals, Region 7		313,724	271,837	23,862,366	87.78	724,465
Grand totals, all regions, all projects.		4,154,499	3,323,341	496,814,975	149.49	3,422,078

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[1] Includes 819 acres of nonirrigable lands irrigated from wasteways and water allotted to irrigable lands.
[2] Districts irrigated in 1954 but not reported in 1956.
[3] Districts irrigated in 1955 but not reported in 1956.
[4] Area for which service is available under Warren Act Contract.
[5] Includes 18,330 acres for which service is available under Warren Act Contract.
[6] Of this irrigable acreage for service, 100,949 acres are in Nebraska and 1,875 acres are in Wyoming.

for each project and reporting organization, 1956—Continued

Supplemental irrigation service lands—Continued			Temporary irrigation service lands				Total			
Irrigated area	Gross crop value		Irrigable area for service	Irrigated area	Gross crop value		Irrigable area for service	Irrigated area	Gross crop value	
	Total	Per irrigated acre			Total	Per irrigated acre			Total	Per irrigated acre
Acres	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*	*Acres*	*Acres*	*Dollars*	*Dollars*
1, 003	33, 593	33. 49	--------	--------	---------	--------	1, 003	1, 003	33, 593	33. 49
6, 054	236, 975	39. 14	--------	--------	---------	--------	6, 054	6, 054	236, 975	39. 14
2, 120	213, 048	100. 49	--------	--------	---------	--------	2, 127	2, 120	213, 048	100. 49
5, 000	216, 965	43. 39	--------	--------	---------	--------	5, 636	5, 000	216, 965	43. 39
62, 334	7, 937, 194	127. 33	--------	--------	---------	--------	63, 324	62, 334	7, 937, 194	127. 33
13, 725	1, 525, 253	111. 13	--------	--------	---------	--------	14, 254	13, 725	1, 525, 253	111. 13
13, 886	966, 010	69. 57	--------	--------	---------	--------	15, 367	13, 886	966, 010	69. 57
950	77, 850	81. 95	--------	--------	---------	--------	950	950	77, 850	81. 95
--------	----------	--------	22, 366	--------	---------	--------	22, 366	--------	----------	--------
105, 072	11, 206, 888	106. 66	22, 366	--------	---------	--------	357, 404	314, 328	29, 960, 177	95. 32
720, 806	76, 748, 753	106. 48	22, 366	--------	---------	--------	1, 060, 555	992, 643	100, 611, 119	101. 36
3, 022, 541	448, 153, 993	148. 27	[1] 82, 224	54, 261	6, 654, 688	122. 64	[1] 7, 658, 801	6, 400, 143	951, 623, 656	148. 69

TABLE 2.—*Irrigation and gross crop value data by type of irrigation service for each State, 1956*

State	Project and division	Full irrigation service		Supplemental irrigation service		Temporary irrigation service		Total		
									Gross crop value	
		Irrigated area	Gross crop value	Irrigated area	Gross crop value	Irrigated area	Gross crop value	Irrigated area	Total	Average per acre irrigated
		Acres	*Dollars*	*Acres*	*Dollars*	*Acres*	*Dollars*	*Acres*	*Dollars*	*Dollars*
Arizona	Gila	56, 978	8, 795, 328					56, 978	8, 795, 328	154. 36
	Salt River	177, 988	59, 203, 483	77, 641	20, 359, 459			255, 629	79, 562, 942	311. 24
	Yuma (see also California)	46, 430	18, 886, 884					46, 430	18, 886, 884	406. 78
	Yuma Auxiliary	2, 597	721, 995					2, 597	721, 995	278. 01
	Subtotals	283, 993	87, 607, 690	77, 641	20, 359, 459			361, 634	107, 967, 149	298. 55
California	Boulder Canyon	536, 151	123, 062, 816					536, 151	123, 062, 816	229. 53
	Cachuma	61		12, 246	8, 373, 399			12, 307	8, 373, 399	680. 38
	Central Valley	30, 623	10, 423, 057	619, 286	181, 307, 732	36, 369	5, 692, 151	686, 278	197, 422, 940	287. 67
	Klamath (see also Oregon)	72, 745	7, 384, 236					72, 745	7, 384, 236	101. 51
	Orland	17, 260	1, 719, 384					17, 260	1, 719, 384	99. 62
	Yuma (see also Arizona)	9, 460	2, 109, 767					9, 460	2, 109, 767	223. 02
	Subtotals	666, 300	144, 699, 260	631, 532	189, 681, 131	36, 369	5, 692, 151	1, 334, 201	340, 072, 542	254. 89
Colorado	Colorado-Big Thompson			615, 000	65, 518, 329			615, 000	65, 518, 329	106. 53
	Fruitgrowers Dam			1, 720	255, 004			1, 720	255, 004	148. 26
	Grand Valley	28, 831	4, 032, 874	7, 730	1, 920, 319			36, 561	5, 953, 193	162. 83
	Mancos			7, 220	323, 582			7, 220	323, 582	44. 82
	Missouri River Basin:									
	Upper Republican Division: St. Francis unit			734	23, 536			734	23, 536	32. 07
	Paonia	8, 900	730, 790					8, 900	730, 790	82. 11
	Pine River			37, 057	2, 015, 024			37, 057	2, 015, 024	54. 38
	Pine River Indian Irrigation			9, 666	349, 977			9, 666	349, 977	36. 21
	Uncompahgre	73, 987	5, 671, 204					73, 987	5, 671, 204	76. 65
	Subtotals	111, 718	10, 434, 868	679, 127	70, 405, 771			790, 845	80, 840, 639	102. 22
Idaho	Avondale	383	20, 667					383	20, 667	53. 96
	Boise (see also Oregon)	200, 227	19, 201, 240	123, 805	14, 813, 889			324, 032	34, 015, 129	104. 97
	Dalton Gardens	396	31, 922					396	31, 922	80. 61
	Lewiston Orchards	2, 085	447, 624					2, 085	447. 624	214. 69

	Minidoka	213, 447	18, 406, 588	808, 133	66, 949, 157	509	50, 824	1, 022, 089	85, 406, 569	83. 56
	Owyhee (see also Oregon)	31, 286	3, 480, 616					31, 286	3, 480, 616	111. 25
	Preston Bench			3, 689	315, 490			3, 689	315, 490	85. 52
	Rathdrum Prairie	3, 488	323, 658					3, 488	323, 658	92. 79
	Subtotals	451, 312	41, 912, 315	935, 627	82, 078, 536	509	50, 824	1, 387, 448	124, 041, 675	89. 40
Kansas	Missouri River Basin:									
	Bostwick Division: Courtland unit	5, 347	404, 812					5, 347	404, 812	75. 71
Montana	Bitter Root	16, 340	588, 779					16, 340	588, 779	36. 03
	Buffalo Rapids	20, 878	1, 249, 495			2, 193	99, 684	23, 071	1, 349, 179	58. 48
	Frenchtown	3, 802	217, 039					3, 802	217, 039	57. 09
	Huntley	24, 426	1, 576, 052					24, 426	1, 576, 052	64. 52
	Intake	737	18, 735					737	18, 735	25. 42
	Lower Yellowstone (see also North Dakota)	32, 591	2, 327, 440			974	54, 207	33, 565	2, 381, 647	70. 96
	Milk River	79, 365	3, 774, 315					79, 365	3, 774, 315	47. 56
	Missoula Valley	768	29, 093					768	29, 093	37. 88
	Missouri River Basin:									
	Three Forks Division: Crow Creek pump unit	897	47, 816					897	47, 816	53. 31
	Yellowstone Division: Savage unit	2, 072	84, 325					2, 072	84, 325	40. 70
	Sun River	66, 967	2, 462, 600					66, 967	2, 462, 600	36. 77
	Subtotals	248, 843	12, 375, 689			3, 167	153, 891	252, 010	12, 529, 580	49. 72
Nebraska	Mirage Flats	11, 235	1, 122, 941					11, 235	1, 122, 941	99. 95
	Missouri River Basin:									
	Bostwick Division: Superior-Courtland unit	14, 567	1, 301, 399					14, 567	1, 301, 399	89. 34
	Frenchman-Cambridge Division	17, 265	1, 710, 144					17, 265	1, 710, 144	99. 05
	North Platte (see also Wyoming)	157, 666	14, 353, 906	90, 236	10, 163, 028			247, 902	24, 516, 934	98. 90
	Subtotals	200, 733	18, 488, 390	90, 236	10, 163, 028			290, 969	28, 651, 418	98. 47
Nevada	Humboldt			29, 795	1, 884, 092			29, 795	1, 884, 092	63. 24
	Newlands	54, 763	2, 949, 148					54, 763	2, 949, 148	53. 85
	Truckee Storage			22, 446	1, 664. 202			22, 446	1, 664, 202	74. 14
	Subtotals	54, 763	2, 949, 148	52, 241	3, 548, 294			107, 004	6, 497, 442	60. 72
New Mexico	Carlsbad	19, 606	4, 416, 796					19, 606	4, 416, 796	225. 28
	Fort Sumner	5, 366	522, 264					5, 366	522, 264	97. 33
	Middle Rio Grande	53, 466	4, 845, 854					53, 466	4, 845, 854	90. 63
	Rio Grande (see also Texas)	82, 110	22, 213, 161					82, 110	22, 213. 161	270. 53
	Tucumcari	33, 140	2, 393, 249					33, 140	2, 393, 249	72. 22
	Vermejo	4, 941	204, 929					4, 941	204, 929	41. 48
	Subtotals	198, 629	34, 596, 253					198, 629	34, 596, 253	174. 18

TABLE 2.—*Irrigation ana gross crop value data by type of irrigation service for each State, 1956*—Continued

State	Project and division	Full irrigation service		Supplemental irrigation service		Temporary irrigation service		Total		
									Gross crop value	
		Irrigated area	Gross crop value	Irrigated area	Gross crop value	Irrigated area	Gross crop value	Irrigated area	Total	Average per acre irrigated
		Acres	*Dollars*	*Acres*	*Dollars*	*Acres*	*Dollars*	*Acres*	*Dollars*	*Dollars*
North Dakota	Buford-Trenton	8, 946	516, 370					8, 946	516, 370	57. 72
	Lower Yellowstone (see also Montana)	16, 740	1, 109, 035			73	4, 080	16, 813	1, 113, 115	66. 21
	Missouri River Basin:									
	Heart Division:									
	Dickinson unit	338	18, 842					338	18, 842	55. 75
	Heart Butte unit	269	9, 886					269	9, 886	36. 75
	North Dakota Pumping Division: Fort Clark unit	573	36, 217					573	36, 217	63. 21
	Subtotals	26, 866	1, 690, 350			73	4, 080	26, 939	1, 694, 430	62. 90
Oklahoma	W. C. Austin	39, 296	4, 967, 297					39, 296	4, 967, 297	126. 41
Oregon	Arnold	2, 891	119, 639					2, 891	119, 639	41. 38
	Baker			7, 305	375, 876			7, 305	375, 876	51, 45
	Boise (see also Idaho)	1, 450	84, 771					1, 450	84, 771	58. 46
	Burnt River			15, 115	649, 568			15, 115	649, 568	42. 98
	Crescent Lake Dam	6, 178	297, 595					6, 178	297, 595	48. 17
	Deschutes	46, 951	6, 014, 045	46, 001	3, 429, 313	819	58, 759	93, 771	9, 502, 117	101. 33
	Grants Pass	7, 378	910, 119					7, 378	910, 119	123. 36
	Klamath (see also California)	116, 732	11, 283, 009					116, 732	11, 283, 009	96. 66
	Ochoco	8, 333	651, 145					8, 333	651, 145	78. 14
	Owyhee (see also Idaho)	67, 694	9, 955, 077	12, 860	3, 436, 099			80, 554	13, 391, 176	166. 24
	Rogue River Basin			12, 809	4, 410, 132			12, 809	4, 410, 132	344. 30
	Umatilla	12, 123	628, 597	10, 922	1, 291, 645	503	78, 273	23, 548	1, 998, 515	84. 87
	Vale	31, 594	2, 192, 167					31, 594	2, 192, 167	69. 39
	Subtotals	301, 324	32, 136, 164	105, 012	13, 592, 633	1, 322	137, 032	407, 658	45, 865, 829	112. 51
South Dakota	Belle Fourche	53, 885	2, 480, 653					53, 885	2, 480, 653	46. 04
	Missouri River Basin:									
	Cheyenne Division: Angostura unit	10, 500	582, 655			220	11, 920	10, 720	594, 575	55. 46
	Rapid Valley			7, 310	241, 749			7, 310	241, 749	33. 07
	Subtotals	64, 385	3, 063, 308	7, 310	241, 749	220	11, 920	71, 915	3, 316, 977	46. 12

Texas	Balmorhea			7, 700	1, 179, 506			7, 700	1, 179, 506	153. 18
	Rio Grande (see also New Mexico)	50, 245	14, 583, 282	5, 180	1, 475, 454			55, 425	16, 058, 736	289. 74
	Subtotals	50, 245	14, 583, 282	12, 880	2, 654, 960			63, 125	17, 238, 242	273. 08
Utah	Hyrum			5, 780	365, 898			5, 780	365, 898	63. 30
	Moon Lake			54, 302	1, 173, 908			54, 302	1, 173, 908	21. 62
	Newton			2, 116	122, 469			2, 116	122, 469	57. 88
	Ogden River			15, 869	1, 906, 267			15, 869	1, 906, 267	120. 13
	Provo River			37, 540	3, 780, 174			37, 540	3, 780, 174	100. 70
	Sanpete			11, 449	470, 450			11, 449	470, 450	41. 09
	Scofield			13, 348	715, 004			13, 348	715, 004	53. 57
	Strawberry Valley	15, 700	845, 203	21, 224	1, 631, 734	4, 026	301, 775	40, 950	2, 778, 712	67. 86
	Weber River			90, 941	8, 804, 350			90, 941	8, 804, 350	96. 81
	Subtotals	15, 700	845, 203	252, 569	18, 970, 254	4, 026	301, 775	272, 295	20, 117, 232	73. 88
Washington	Columbia Basin	174, 788	22, 413, 081					174, 788	22, 413, 081	128. 23
	Okanogan	3, 972	650, 545					3, 972	650, 545	163. 78
	Yakima	227, 130	51, 326, 051	163, 530	35, 414, 318	194	27, 720	390, 8548	6, 768, 089	222. 00
	Subtotals	405, 890	74, 389, 677	163, 530	35, 414, 318	194	27, 720	569, 614	109, 831, 715	192. 82
Wyoming	Eden	8, 571	300, 659					8, 571	300, 659	35. 08
	Kendrick	14, 167	569, 781					14, 167	569, 781	40. 22
	North Platte (see also Nebraska)	51, 590	4, 399, 383	14, 836	1, 043, 860			66, 426	5, 443, 243	81. 94
	Riverton	48, 968	2, 030, 149			8, 381	275, 295	57, 349	2, 305, 444	40. 20
	Shoshone	74, 701	4, 371, 297					74, 701	4, 371, 097	58. 52
	Subtotals	197, 997	11, 671, 269	14, 836	1, 043, 860	8, 381	275, 295	221, 214	12, 990, 424	58. 72
	Grand totals, all States	3, 323, 341	496, 814, 975	3, 022, 541	448, 153, 993	54, 261	6, 654, 688	6, 400, 143	951, 623, 656	148. 69

TABLE 3.—*Acreage, production, and gross crop value by crops and types of crops 1956*

Crops	Irrigated lands		Tonnage		Gross crop value	
	Total	Percent of total	Total	Percent of total	Total	Percent of total [1]
Cereals:	*Acres*	*Percent*	*Tons*	*Percent*	*Dollars*	*Percent*
Barley	534,700	8.35	683,427	2.41	29,985,079	3.15
Corn	225,586	3.52	390,065	1.37	20,428,856	2.15
Oats	196,467	3.07	166,722	.59	7,778,894	.82
Rice	8,650	.14	15,007	.05	1,912,364	.20
Rye	2,957	.05	2,364	.01	124,661	.01
Sorghums	90,029	1.41	112,440	.40	5,554,336	.58
Wheat	440,408	6.88	591,281	2.08	34,618,601	3.64
Other	62,097	.97	84,158	.30	3,337,534	.35
Subtotals	1,560,894	24.39	2,045,464	7.21	103,740,325	10.90
Forage:						
Alfalfa hay	1,612,128	25.19	5,833,129	20.55	121,820,769	12.80
Other hay	224,108	3.50	462,126	1.63	8,456,898	.89
Irrigated pasture	967,077	15.11	2,585,835	9.11	30,122,072	3.16
Corn fodder	9,669	.15	74,821	.26	500,047	.05
Silage or ensilage	158,457	2.48	1,850,324	6.52	14,323,757	1.51
Crop residue: Beet tops	----------	----------	2,005,875	7.07	1,488,814	.16
Stubble, stalks, etc	----------	----------	192,665	.68	1,343,597	.14
Straw	----------	----------	220,210	.77	1,229,233	.13
Root crops	63	----------	409	----------	2,190	----------
Other forage	29,521	.46	96,223	.34	1,527,408	.16
Subtotals	3,001,023	46.89	13,321,617	46.93	180,814,785	19.00
Miscellaneous field crops:						
Beans, castor	430	.01	381	----------	55,103	.01
Beans, dry and edible	286,871	4.48	237,170	.84	27,735,480	2.91
Broomcorn	4,325	.07	1,139	.01	367,316	.04
Cotton, lint (upland)	417,757	6.53	193,779	.68	132,988,752	13.97
Cotton, seed (upland)	----------	----------	302,080	1.06	18,834,832	1.98
Cotton, lint (American-Egyptian)	20,032	.31	5,220	.02	6,553,332	.69
Cotton, seed (American-Egyptian)	----------	----------	9,680	.03	667,254	.07
Hops	14,254	.22	12,421	.04	10,062,880	1.06
Peppermint	10,154	.16	394	----------	3,107,120	.33
Spearmint	3,028	.05	120	----------	848,360	.09
Sugar beets	351,662	5.49	6,233,271	21.96	63,201,664	6.64
Other miscellaneous field crops	6,665	.10	19,893	.07	780,637	.08
Subtotals	1,115,178	17.42	7,015,548	24.71	265,202,730	27.87
Vegetables:						
Asparagus	11,558	.18	19,934	.07	4,321,062	.45
Beans (processing)	7,056	.11	14,436	.05	1,688,235	.18
Beans (fresh market)	1,677	.03	5,322	.02	958,733	.10
Broccoli	759	.01	3,262	.01	337,296	.04
Cabbage	2,760	.04	38,826	.14	814,088	.09
Carrots	10,376	.16	116,527	.41	9,927,404	1.04
Cauliflower	7	----------	53	----------	3,677	----------
Celery	283	----------	6,520	.02	388,976	.04
Corn, sweet (processing)	20,215	.32	105,715	.37	2,339,504	.25
Corn, sweet (fresh market)	6,041	.09	15,531	.05	1,547,816	.16
Cucumbers	1,938	.03	9,681	.03	656,998	.07
Greens (kale, etc.)	415	.01	2,490	.01	174,300	.02
Lettuce	58,543	.92	433,425	1.53	32,555,177	3.42
Melons: Cantaloupes, etc	32,968	.52	147,131	.52	13,311,360	1.40
Honey Ball, honeydew, etc	4,780	.07	50,092	.18	2,644,037	.28
Watermelons	9,264	.14	65,154	.23	2,573,573	.27
Onions, dry	9,944	.15	155,844	.55	5,813,507	.61
Onions, green	571	.01	1,364	.01	168,350	.02
Peas, green (processing)	16,198	.25	26,689	.09	2,207,699	.23
Peas, green (fresh market)	1,683	.03	3,709	.01	828,210	.09
Peppers	2,933	.05	10,618	.04	2,331,671	.24
Potatoes, early	39,526	.62	488,897	1.72	27,615,180	2.90
Potatoes, late	182,582	2.85	1,829,103	6.44	41,772,467	4.39
Squash	2,997	.05	9,217	.03	1,141,923	.12
Sweet potatoes	658	.01	2,420	.01	250,147	.03
Tomatoes (canning)	23,484	.37	316,381	1.12	7,505,447	.79
Tomatoes (fesh market)	10,583	.17	86,840	.31	12,752,795	1.34
Other vegetables	6,719	.10	46,321	.16	2,531,004	.26
Subtotals	466,518	7.29	4,011,502	14.13	179,160,636	18.83
Total nursery	3,219	.05	----------	----------	5,303,844	.56

TABLE 3.—*Acreage, production, and gross crop value by crops and types of crops 1956*—Continued

Crops	Irrigated lands		Tonnage		Gross crop value	
	Total	Percent of total	Total	Percent of total	Total	Percent of total [1]
	Acres	*Percent*	*Tons*	*Percent*	*Dollars*	*Percent*
Seeds:						
Alfalfa	112,732	1.76	20,387	0.07	11,820,792	1.24
Clover	39,438	.62	7,331	.03	4,538,423	.48
Corn	6,278	.10	7,882	.03	1,071,348	.11
Flaxseed	43,331	.68	28,341	.10	3,580,558	.38
Grass	12,088	.19	2,606	.01	1,957,787	.21
Lettuce	1,550	.02	182		306,743	.03
Onion	664	.01	156		225,296	.02
Pea	50,746	.79	48,034	.17	4,604,343	.48
Potato	540	.01	7,180	.03	423,198	.04
Sugar beet	2,115	.03	3,119	.01	928,215	.10
Other seed	8,716	.14	6,590	.02	1,291,897	.14
Subtotal	278,198	4.35	131,808	.47	30,748,600	3.23
Fruits:						
Apples	39,910	.62	294,800	1.04	30,536,925	3.21
Apricots	5,236	.08	26,748	.09	3,100,330	.33
Berries	1,712	.03	2,915	.01	1,189,613	.12
Cherries	5,348	.08	9,582	.03	2,280,619	.24
Citrus:						
Grapefruit	12,230	.19	174,813	.62	6,620,851	.69
Lemons and limes	9,326	.15	81,220	.29	6,368,115	.67
Oranges and tangerines	28,705	.45	270,433	.95	20,993,213	2.21
Dates	4,264	.07	16,805	.06	6,060,841	.64
Grapes, table	50,658	.79	315,014	1.11	28,707,219	3.02
Grapes, other	31,406	.49	250,744	.88	11,975,120	1.26
Olives	8,057	.12	21,656	.08	4,220,992	.44
Peaches	26,298	.41	153,681	.54	11,736,398	1.23
Pears	22,382	.35	177,987	.63	12,605,033	1.32
Prunes and plums	8,721	.14	47,217	.17	3,558,928	.37
Other fruits	3,107	.05	6,098	.02	1,031,273	.11
Subtotals	257,360	4.02	1,849,713	6.52	150,985,470	15.86
Nuts:						
Almonds	5,398	.09	2,475	.01	1,993,340	.21
Pecans	4,475	.07	2,501	.01	1,612,022	.17
Walnuts	5,937	.09	4,152	.01	2,222,388	.23
Other nuts	94		.74		53,110	.01
Subtotals	15,904	.25	9,202	.03	5,880,860	.62
Family gardens and orchards	19,336	.30			3,660,941	.38
Total, all crops	6,717,630	104 96	28,384,854	100.00	925,498,191	97.25
Less multiple cropped	453,778	7.09				
Total harvested cropland and pasture	6,263,852	97.87				
Cropland not harvested	121,668	1.90				
Soil building	14,623	.23				
Acres irrigated	6,400,143	100.00				
Additional revenues [2]					26,125,465	2.75
Total gross crop value					951,623,656	100.00
Full irrigation service	3,323,341				496,814,975	
Supplemental irrigation service	3,022,541				448,153,993	
Temporary irrigation service	54,261				6,654,688	

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[1] Additional revenues are included in computing percentages.

[2] Includes payments received from Federal and commercial agencies.

TABLE 4.—*Repayment contracts—matured and unmatured, June 30, 1957*

Project and State	Value of repayment contracts			Unmatured value of repayment contracts				Matured value of repayment contracts	Amount due and unpaid [1]
	Construction	Rehabilitation and betterment	Total	Construction	Deferred charges	Rehabilitation and betterment	Total		
PROPERTY TITLED IN UNITED STATES									
Avondale, Idaho	$244,423.61		$244,423.61	$244,423.61			$244,423.61		
W. C. Austin, Oklahoma	3,262,188.49		3,262,188.49	2,689,665.00			2,689,665.00	$572,523.49	
Baker, Oregon	225,014.54		225,014.54	86,545.34	$20,193.25		106,738.59	118,275.95	
Balmorhea, Texas	255,600.00		255,600.00	231,399.50			231,399.50	24,200.50	
Belle Fourche, South Dakota	4,230,059.65		4,230,059.65	2,679,945.95			2,679,945.95	1,550,113.70	
Bitter Root, Montana	1,052,741.05	$225,000.00	1,277,741.05	669,815.62		$225,000.00	894,815.62	382,925.43	
Boise, Idaho-Oregon	28,268,576.86	2,225,000.00	30,493,576.86	14,642,423.32	1,033,381.40	2,225,000.00	17,900,804.72	12,592,772.14	$3,102.35
Boulder Canyon, Arizona-California:									
All-American Canal System	52,444,205.61		52,444,205.61	51,470,600.45			51,470,600.45	973,605.16	
Buffalo Rapids, Montana	1,626,000.00		1,626,000.00	1,559,700.00			1,559,700.00	66,300.00	10,950.00
Burnt River, Oregon	599,735.00		599,735.00	329,842.40			329,842.40	269,892.60	
Cachuma, California	5,800,000.00		5,800,000.00	5,797,443.00			5,797,443.00	2,557.00	
Carlsbad, New Mexico	3,741,760.67	25,000.00	3,766,760.67	1,825,993.72	64,070.00	23,500.00	1,913,563.72	1,853,196.95	
Central Valley, California	62,483,022.35		62,483,022.35	62,342,519.95			62,342,519.95	140,502.40	
Chief Joseph Dam, Foster Creek Division, Washington	1,373,200.00		1,373,200.00	1,373,200.00			1,373,200.00		
Colorado-Big Thompson, Colorado	26,032,704.85		26,032,704.85	26,032,576.99			26,032,576.99	127.86	
Colorado River, Texas	5,510,500.00		5,510,500.00	5,510,500.00			5,510,500.00		
Columbia Basin, Washington	87,547,720.80		87,547,720.80	87,479,490.52			87,479,490.52	68,230.28	229.53
Crescent Lake Dam, Oregon		320,000.00	320,000.00			320,000.00	320,000.00		
Dalton Gardens, Idaho	270,200.00		270,200.00	270,200.00			270,200.00		
Deschutes, Oregon	12,757,159.80		12.757,159.80	12,460,630.30			12,460,630.30	296,529.50	
Eden, Wyoming	1,500,000.00		1,500,000.00	1,500,000.00			1,500,000.00		
Fort Sumner, New Mexico	2,432,166.55		2,432,166.55	2,310,558.23			2,310,558.23	121,608.32	
Frenchtown, Montana	297,282.04		297,282.04	229,056.63			229,056.63	68,225.41	
Fruitgrowers Dam, Colorado	198,240.71		198,240.71	137,397.79			137,397.79	60,842.92	
Gila, Arizona	48,116,167.45		48,116,167.45	48,092,417.47			48,092,417.47	23,749.98	
Grand Valley, Colorado	2.124,314.37	1,838,327.73	3,962,642.10	1,249,721.38		1,806,827.73	3,056,549.11	906,092.99	
Humboldt, Nevada	1,211,244.68	123,000.00	1,334,244.68	711,956.26	26,902.68	123,000.00	861,858.94	472,385.74	
Huntley, Montana	1,839,673.68	100,000.00	1,939,673.68	680,900.87	91,104.91	100,000.00	872,005.78	1,067,667.90	
Hyrum, Utah	944,046.36		944,046.36	652,112.00			652,112.00	291,934.36	
Intake, Montana	46,900.00		46,900.00	42,194.00			42,194.00	4,706.00	
Kendrick, Wyoming	2,800,000.00		2,800,000.00	2,800,000.00			2,800,000.00		
Klamath, Oregon-California	7,759,344.20	40,200.26	7,799,544.46	4,451,230.02	164,651.86	30,150.00	4,646,031.88	3,153,512.58	25,302.30
Lewiston Orchards, Idaho	2,500,000.00		2,500,000.00	2,415,071.44			2,415,071.44	84,928.56	
Lower Yellowstone, Montana-North Dakota	4,087,893.81		4,087,893.81	1,288,319.13	279,703.78		1,568,022.91	2,519,870.90	45,800.52

Mancos, Colorado	900,000.00		900,000.00	855,000.00			855.000.00	45,000.00	
Michaud Flats, Idaho	2,875,000.00		2,875,000.00	2,875,000.00			2,875,000.00		
Middle Rio Grande, New Mexico	15,740,000.00		15,740,000.00	15,740,000.00			15,740,000.00		
Milk River, Montana	7,777,644.89	134,851.00	7,912,495.89	6,376,440.13	48,508.78	134,851.00	6,559,799.91	1,352,695.98	16,949.22
Minidoka, Idaho-Wyoming	21,795,896.47		21,795,896.47	4,747,758.55	120.37		4,747,878.92	17,048,017.55	1,044.73
Mirage Flats, Nebraska	841,917.53		841,917.53	799,137.53			799,137.53	42,780.00	11,390.00
Missoula Valley, Montana	45,000.00		45,000.00	44,156.00			44,156.00	844.00	210.71
Missouri River Basin	34,970,824.00		34,970,824.00	34,970,739.02			34,970,739.02	84.98	
Moon Lake, Utah	1,592,267.76		1,592,267.76	1,034,974.04			1,034,974.04	557,293.72	
Newlands, Nevada	3,257,749.35		3,257,749.35	395,885.44	70,000.00		465,885.44	2,791,863.91	
Newton, Utah	350,000.00		350,000.00	271,250.00			271,250.00	78,750.00	
North Platte, Nebraska-Wyoming	20,236,195.85	3,779,590.40	24,015,786.25	3,801,396.90	90,860.00	3,653,281.94	7,545,538.84	16,470,247.41	1,770.23
Ogden River, Utah	4,734,935.11		4,734,935.11	3,390,120.82			3,390,120.82	1,344,814.29	
Okanogan, Washington	468,597.85	126.000.00	594,597.85	218,279.74		126,000.00	344,279.74	250,318.11	
Orland, California	2,457,212.15	542,413.23	2,999,625.38	654,229.55	296,763.34	438,270.22	1,389,263.11	1,610,362.27	8,145.67
Owyhee, Oregon-Idaho	19,826,659.47		19,826,659.47	17,309,404.62			17,309,404.62	2,517,254.85	3,596.75
Palisades, Idaho	7,301,675.00		7,301,675.00	7,301,675.00			7,301,675.00		
Palo Verde, California	1,675,000.00		1,675,000.00	1,665,000.00			1,665,000.00	10.000.00	
Paonia, Colorado	2,320,000.00		2,320,000.00	2,320,000.00			2,320,000.00		
Pine River, Colorado	1,500,000.00		1,500,000.00	1,170,820.00			1,170,820.00	329,180.00	
Provo River, Utah	32,136,886.65		32,136,886.65	28,717,581.85			28,717,581.85	3,419,304.80	
Rapid Valley, South Dakota	1,100,000.00		1,100,000.00	975,000.00			975,000.00	125,000.00	
Rathdrum Prairie, Idaho	855,909.19		855,909.19	790,003.27			790,003.27	65,905.92	
Rio Grande, New Mexico-Texas	10,144,123.26		10,144,123.26	2,343,150.53	557,962.05		2,901,112.58	7,243,010.68	
Riverton, Wyoming	7,381,827.26	2,500,000.00	9,881.827.26	6,716,377.52		2,500,000.00	9,216,377.52	665,449.74	22,116.17
Rogue River-Talent Division, Oregon	5,810,000.00		5,810,000.00	5,810,000.00			5,810,000.00		
Salt River, Arizona	17,482,687.89	6,757,303.71	24,239,991.60	4,516,320.35		5,742,561.39	10,258,881.74	13,981,109.86	
San Luis Valley, Colorado	2,520,000.00		2,520.000.00	2,520,000.00			2,520,000.00		
Sanpete, Utah	373,375.94		373,375.94	214,481.11	2,375.00		216,856.11	156,519.83	
Santa Maria, California	13,969,000.00		13,969,000.00	13,969,000.00			13,969,000.00		
Scofield, Utah	247,000.00		247,000.00	162,000.00			162,000.00	85,000.00	
Shoshone, Wyoming-Montana	6,827,609.52	380,000.00	7,207,609.52	4,091,636.78	6,964.28	380,000.00	4,478,601.06	2,729,008.46	
Strawberry Valley, Utah	3,349,423.92		3,349,423.92	675,530.94			675,530.94	2,673,892.98	
Sun River, Montana	9,963,584.93	38,151.04	10,001,735.97	8,202,360.92		36,351.04	8,239,211.96	1,762,524.01	
Truckee Storage, Nevada	1,000,000.00		1,000,000.00	649,660.42			649.660.42	350,339.58	
Tucumcari, New Mexico	5,901,896.86		5,901,896.86	5,856,041.02			5,856,041.02	45,855.84	
Umatilla, Oregon	1,044,212.22		1,044,212.22	564,065.76			564,065.76	480.146.46	5,766.27
Uncompahgre, Colorado	6,874,017.36		6,874,017.36	5,607,179.07			5,607,179.07	1,266,838.29	
Vale, Oregon	5,022,287.50		5,022,287.50	4,475,646.86			4,475,646.86	546,640.64	
Ventura River, California	27,500,000.00		27,500,000.00	27,500,000.00			27,500,000.00		
Vermeyo, New Mexico	2,107,943.33		2,107,943.33	2,107,943.33			2,107,943.33		
Weber Basin, Utah	57,694,000.00		57,694,000.00	57,694,000.00			57,694,000.00		
Weber Basin, Utah	2,685,871.83		2,685,871.83	793,736.14			793,736.14	1,892,135.69	
Yakima, Washington	46,497,633.59	719,262.47	47,216,396.06	32,765,162.15	42,084.99	505,929.30	33,313,176.44	13,903,719.62	
Yuma, Arizona-California	5,365,876.73		5,365,876.73	181,840.83			181,840.83	5,184,035.90	143.35
Yuma Auxiliary, California	1,560,268.39		1,560,268.39	992,573.88			992,573.88	567,694.51	2,240.00
Subtotal, U. S. total	799,664,098.93	19,874,099.84	819,538,198.77	669.090,910.96	2,795,646.69	18,370,722.62	690,257,280.27	129,280,918.50	158,757.80

See footnote at end of table

TABLE 4.—*Repayment contracts—matured and unmatured, June 30, 1957*—Continued

Project and State	Value of repayment contracts			Unmatured value of repayment contracts				Matured value of repayment contracts	Amount due and unpaid [1]
	Construction	Rehabilitation and betterment	Total	Construction	Deferred charges	Rehabilitation and betterment	Total		
PROPERTY TITLED IN WATER USERS									
Arnold, Oregon		$197, 925. 82	$197. 925. 82			$165, 039. 81	$165, 039. 81	$32, 886. 01	
Grand Valley, Colorado	$1, 004, 839. 84		1, 004, 839. 84	$390, 790. 96			390, 790. 96	614, 018. 88	
Grants Pass, (S. R. D.), Oregon		950, 000. 00	950, 000. 00			937, 500. 00	937, 500. 00	12, 500. 00	
Ochoco, Oregon		500, 000. 00	500, 000. 00			500, 000. 00	500, 000. 00		
Preston Bench, Idaho	450, 300. 33		450, 300. 33	450, 300. 33			450. 300 33		
Rogue River, Oregon		1, 712, 000. 00	1, 712, 000. 00			1, 712, 000. 00	1, 712, 000. 00		
Umatilla, Oregon	97, 830. 24		97, 830. 24	52, 677. 78			52, 677. 78	45, 152. 46	
Subtotal, Water Users Title	1, 552, 970. 41	3, 359, 925. 82	4, 912, 896. 23	893, 769. 07		3, 314, 539. 81	4, 208, 308. 88	704, 587. 35	
Total repayment contracts	801, 217, 069. 34	23, 234, 025. 66	824, 451, 095. 00	669, 984, 680. 03	$2, 795, 646. 69	21, 685, 262. 43	694, 465, 589. 15	129, 985, 505. 85	$158, 757. 80

[1] $129,964.48 paid by October 31, 1957.

Each of the 17 Western States participated in the Reclamation harvest for 1956. Idaho had a larger acreage of irrigated Federal project lands than any of the other States, followed by California, Colorado, Washington, Oregon, Arizona, Nebraska, Utah, and Montana. The gross value of crops produced on Federal projects located in California was higher than for the other Western States; however, the average gross crop value per acre was highest for Arizona, followed by Texas, California, Washington, New Mexico, Oklahoma, etc.

Repayment and Water Service Contracts

During fiscal year 1957, contracts were executed with a number of districts for the repayment of the cost of new project works. The distribution system loan repayment contract with the Solano Irrigation District, Solano project, California, was the first loan repayment contract to be executed under the new loan program authorized by Public Law 130 of the 84th Congress (69 Stat. 244). After this contract has been validated in the courts of California, the United States will advance funds on an approved schedule basis to the Solano Irrigation District over a period of years to permit the District to finance construction of distribution system works.

The Solano Irrigation District is one of several member units that have contracted with the Solano County Flood Control and Water Conservation District for water service from the Solano project. All of these member unit contracts have been validated in the courts of California. Negotiations were well advanced with several districts of the Central Valley project for similar distribution system loans.

Amendment in June of 1957 of the Small Reclamation Project Act, as requested by the President, and approval by the Secretary of the Interior on July 5, 1957, of a small project loan request by the Cameron County Water Improvement District No. 1, located in the lower Rio Grande Valley of Texas, cleared the way for initiation of repayment contract negotiations for the first small project loan.

Repayment contracts involving new construction work were executed with the Bridgeport Irrigation District, Chief Joseph Dam project, Idaho; Juniper Flats District Improvement Co., Wapinitia project, Oregon; Collbran Conservancy District, Collbran project, Colorado; and with the following organizations of the Missouri River Basin project: Owl Creek Irrigation District and Helena Valley Irrigation District in Montana, Loup Basin Reclamation District in Nebraska, Ainsworth Irrigation District in Nebraska, Frenchman

Valley Irrigation District in Nebraska, H. and R. W. Irrigation District in Nebraska, and the Webster Irrigation District in Kansas.

* * * * * * *

During the fiscal year, negotiations were carried to completion for execution of a repayment contract (actually executed shortly after close of fiscal year, on July 23, 1957) with the Fort Cobb Master Conservancy District, Fort Cobb Division, Washita project, Oklahoma. The contractual arrangements are unique in that first stage construction involves municipal water, with irrigation scheduled for second stage construction. In the event irrigation does not develop within 10 years of the time when municipal water becomes available, then the authorization of the irrigation features expires. If irrigation fails to develop, municipal water payments will continue until all of the reimbursable costs of the project, including those allocated to irrigation, are fully repaid. Municipal water costs are to be repaid with interest on the unamortized balance at a rate certified by the Secretary of the Treasury of 2.591 percent.

Considerable progress was made in the negotiation of water service contracts for the Sacramento Canals Unit of the Central Valley project, California. The first contract to be executed for this service area was with the Corning Water District. At the close of the fiscal year negotiations had been completed with the Westside Water District, Dunnigan Water District, Colusa County Water District, Kanawha Water District, and the Proberta Water District.

Contract negotiations in California, however, have been affected by the action of the California Supreme Court in the *Ivanhoe* case, wherein the court held water users organizations in California were not empowered to execute contracts containing excess land provisions. Pending a review of the matter by the United States Supreme Court, which has been requested, the Government is continuing to make water deliveries in compliance with existing contract requirements.

The contract executed with the Yuma County Water Users Association, Valley Division, Yuma project, Arizona, as authorized by the act of June 29, 1956 (70 Stat. 409), provided for final repayment of the remaining reimbursable costs of the Valley Division. A number of contracts also were executed involving rehabilitation and betterment of project works and providing for temporary or interim water supplies.

Table 4 shows that the total value of repayment contracts on June 30, 1957, amounted to $824,451,095. Of this amount, a total of $129,826,748 had been repaid, and delinquencies were insignificant. In addition, over $100 million will be returned to the Government in water service payments under contracts now in force.

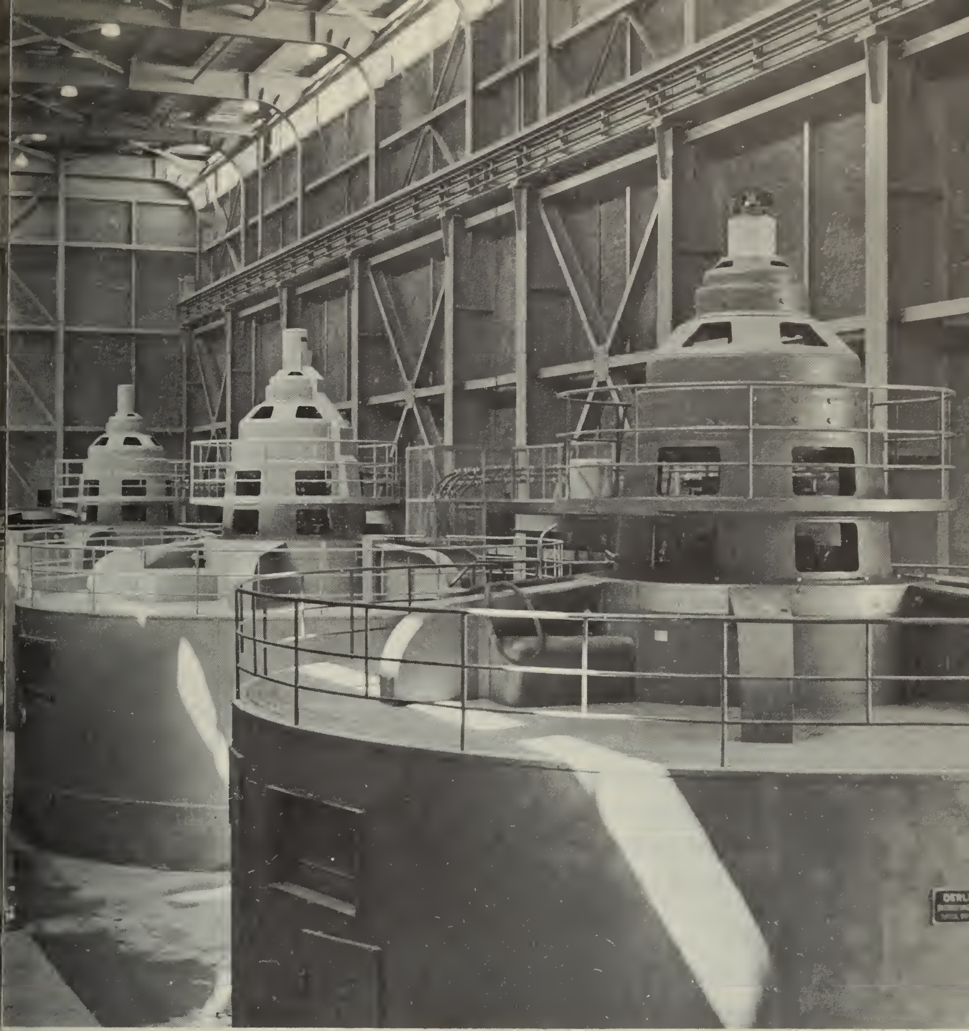

FIGURE 4.—More power for Northwest. These four generators installed in the powerplant at the Palisades Dam on the Snake River in Idaho to furnish 114,000 additional kilowatts of hydroelectric power for the Pacific Northwest, are typical of operations under the Federal Reclamation program which last year provided more than 25.6 billion kilowatt-hours of electric power. The 36 powerplants constructed in the West by the Bureau of Reclamation have a total installed capacity of 5,031,550 kilowatts.

Land Openings

The Bureau conducted five land openings on three Reclamation projects, making available for settlement 290 farm units embracing 33,482 irrigable acres of new land. The greatest number were on the North Side pumping unit of the Minidoka project in Idaho where 145 units were opened for settlement under the provisions of reclamation and homestead laws. Six farm units were offered for homestead entry on the Hanover-Bluff unit, Bighorn Basin Division, Missouri River Basin project. The remaining 139 units were offered for sale through three separate openings on the Columbia Basin project in Washington, under the provisions of the Columbia Basin Project Act.

Since the close of World War II, 57 land openings have been held on 14 Reclamation projects. A total of 2,684 new farm units encompassing approximately 235,000 irrigable acres of public land have thus been made available for selection by qualified applicants.

The availability of additional new farm units is anticipated during fiscal year 1958 on the Columbia Basin project in Washington, the Minidoka project in Idaho, and on the Gila and Yuma projects in Arizona. Additional privately owned lands in the Central Valley, Columbia Basin, and Missouri Basin projects will be supplied with irrigation water. A considerable amount of this privately owned land may be available for sale by the owners.

Development Farms

A vital part of the settlement program on areas being newly developed for irrigation is the development farm program, started in 1947. These farms are conducted in cooperation with various agricultural agencies and State agricultural colleges.

Field scale operations are conducted to demonstrate to the inexperienced irrigation farmers the layout of most practical farm irrigation systems, the best methods of irrigation, the crops best adapted to the area, and the most effective cultural practices.

The research conducted by the cooperating agricultural agencies, on the 10 to 20 percent of each farm set aside for this purpose, furnishes valuable information to the new settlers. Field days, tours, and other educational media are used to disseminate the information obtained from the research and to explain the demonstrations to the farmers.

The farm sites are chosen in cooperation with other interested agencies in areas best representing the soils and other conditions common to the project. They are established 2 to 5 years in advance of settlement in order to have the desired information by the time the new settlers arrive.

During fiscal year 1957 there were 15 development farms in operation on the Columbia Basin, Gila, and Missouri River Basin projects, with several new farms proposed for the latter project.

Soil and Moisture Conservation Operations

The Bureau of Reclamation continued to make progress in protecting the land and facilities under its jurisdiction.

Protection of land from wind and water erosion, reduction of moisture losses from land and water areas, and the protection of Reclamation-built structures from the adverse effects of soil erosion was continued by the Bureau during the year. The work included structural installations, reseeding, and other means of erosion control and stabilization.

The planning, financing, and performance of the work are accomplished in cooperation with other Federal agencies and State and local agencies, including water users' organizations.

Weed Control

The weed control program conducted by the Bureau on irrigation systems has reduced the problems caused by undesirable vegetation and also cut operation and maintenance costs. It also aided materially in reducing water losses resulting from transpiration, evaporation, and seepage due to weed growths.

More efficient and economical methods of controlling weeds infesting banks and channels of irrigation systems were developed and put into practice through the research program conducted by the Agricultural Research Service, Department of Agriculture, in cooperation with the Bureau of Reclamation. This work has been accomplished at field stations at Phoenix, Ariz.; Prosser, Wash.; Bozeman, Mont.; and Laramie, Wyo., and in the Reclamation weed control laboratory in Denver.

Under the provisions of the Halogeton Glomeratus Act (Public Law 529, July 14, 1952), the Bureau is cooperating in the control of the poisonous weed halogeton on Bureau lands in Utah, Nevada, Colorado, Wyoming, Montana, and Idaho.

Cooperation With Other Agencies

Certain of the Bureau's activities in planning, developing, and operating its irrigation projects are accomplished or facilitated through cooperation with other agencies, when the employment of their special skills, experience, and equipment will be beneficial to the Government.

These cooperative undertakings are carried out by means of agreements between the Bureau and the other agencies involved which include, principally, units of the Department of Agriculture and the State colleges and extension services, but often involve other Federal, State, and local agencies.

During fiscal year 1957 there were nearly 200 such cooperative agreements in effect. They pertain to studies and investigations conducted on development farms, conservation and efficient use of soil and water, crop and cropping problems, assistance to county agricultural agents, and weed control studies. They cover also the development and management of reservoir recreational areas, financial aid to new settlers, and assistance in solving many other problems pertaining to the development of irrigation projects.

TABLE 5.—*Hydroelectric powerplants*

State or Territory	Project	Name of plant	Calendar year of initial operation	Nameplate rating	
				Existing (kilowatts)	Ultimate (kilowatts)
		A. Constructed and operated by Bureau of Reclamation			
1. Alaska	Eklutna	Eklutna	1955	30, 000	30, 000
2. Alaska	do	Old Eklutna [1]	1955	2, 000	2, 000
3. Arizona-Nevada	Boulder Canyon	Hoover [2]	1936	1, 249, 800	1, 354, 300
4. Arizona-Nevada	Parker-Davis	Davis	1951	225, 000	225, 000
5. Arizona-Nevada	do	Parker	1942	120, 000	120, 000
6. California	Central Valley	Folsom	1955	162, 000	162, 000
7. California	do	Keswick	1949	75, 000	75, 000
8. California	do	Nimbus	1955	13, 500	13, 500
9. California	do	Shasta	1944	379, 000	379, 000
10. California	Yuma	Siphon Drop	1926	1, 600	1, 600
11. Colorado	Colorado-Big Thompson	Estes	1950	45, 000	45, 000
12. Colorado	do	Flatiron	1954	71, 500	71, 500
13. Colorado	do	Green Mountain	1943	21, 600	21, 600
14. Colorado	do	Marys Lake	1951	8, 100	8, 100
15. Colorado	do	Polehill	1954	33, 250	33, 250
16. Colorado	Grand Valley	Grand Valley [3]	1932	3, 000	3, 000
17. Idaho	Boise	Anderson Ranch	1950	27, 000	40, 500
18. Idaho	do	Black Canyon	1925	8, 000	8, 000
19. Idaho	do	Boise Diversion	1912	1, 500	1, 500
20. Idaho	Minidoka	Minidoka	1909	13, 400	13, 400
21. Idaho	Palisades	Palisades	1957	57, 000	114, 000
22. Montana	Missouri River Basin	Canyon Ferry	1953	50, 000	50, 000
23. Montana	Hungry Horse	Hungry Horse	1952	285, 000	285, 000
24. New Mexico	Rio Grande	Elephant Butte	1940	24, 300	24, 300
25. South Dakota	Missouri River Basin	Angostura	1951	1, 200	1, 200
26. Washington	Columbia Basin	Grand Coulee	1941	1, 974, 000	1, 974, 000
27. Washington	Yakima-Kennewick	Chandler	1956	12, 000	12, 000
28. Wyoming	Kendrick	Alcova	1955	36, 000	36, 000
29. Wyoming	do	Seminoe	1939	32, 400	32, 400
30. Wyoming	Missouri River Basin	Boysen	1952	15, 000	15, 000
31. Wyoming	do	Kortes	1950	36, 000	36, 000
32. Wyoming	North Platte	Guernsey	1927	4, 800	4, 800
33. Wyoming	do	Lingle [4]	1919	1, 400	1, 400
34. Wyoming	Riverton	Pilot Butte	1925	1, 600	1, 600
35. Wyoming	Shoshone	Heart Mountain	1948	5, 000	5, 000
36. Wyoming	do	Shoshone	1922	5, 600	5, 600
		Subtotal A		5, 031, 550	5, 206, 550
		B. Constructed and operated by others—power marketed by United States Bureau of Reclamation			
1. Montana	Fort Peck (USCE)	Fort Peck	1943	85, 000	165, 000
2. North Dakota	Missouri River Basin (USCE)	Garrison	1956	240, 000	400, 000
3. South Dakota	do	Fort Randall	1954	320, 000	320, 000
4. South Dakota	do	Gavins Point	1956	100, 000	100, 000
5. Texas	Falcon (IBWC)	Falcon	1954	31, 500	42, 000
		Subtotal B		776, 500	1, 027, 000

TABLE 5.—*Hydroelectric powerplants*—Continued

State or Territory	Project	Name of plant	Calendar year of initial operation	Nameplate rating	
				Existing (kilowatts)	Ultimate (kilowatts)
C. Under construction by Bureau of Reclamation					
1. Arizona	Colorado River Storage	Glen Canyon	1963		900,000
2. Colorado	Colorado-Big Thompson	Big Thompson	1959		4,500
3. Oregon	Rogue River	Green Springs	1959		16,000
4. Utah	Colorado River Storage	Flaming Gorge	1963		105,000
5. Utah	Provo River Basin	Deer Creek	1957		5,000
6. Utah	Weber Basin	Gateway	1958		4,000
7. Utah	do	Wanship	1958		1,400
8. Washington	Yakima-Roza	Roza	1958		11,250
9. Wyoming	Missouri River Basin	Glendo	1958		24,000
10. Wyoming	do	Fremont Canyon	1960		48,000
		Subtotal C			1,119,150
D. Under construction by others—power to be marketed by United States Bureau of Reclamation					
1. South Dakota	Missouri River Basin (USCE)	Oahe	1962		595,000
		Subtotal D			595,000
		Total		5,808,050	7,947,700

NOTES:
[1] Acquired from city of Anchorage for operation with Eklutna Project fiscal year 1955.
[2] Powerplant units operated by Southern California Edison Co. and city of Los Angeles Department of Water and Power as agents of the United States.
[3] Leased to Public Service Co. of Colorado for operation.
[4] On nonoperating status from May 1, 1956.
U. S. C. E.—United States Corps of Engineers.
I. B. W. C.—International Boundary and Water Commission.

HYDROELECTRIC POWER DEVELOPMENT

Present Installed Capacity

In order to utilize to the greatest extent, the water storage at multipurpose reservoirs, the Bureau of Reclamation has constructed 36 powerplants with an installed nameplate capacity of 5,031,550 kilowatts. In addition, the Bureau is responsible for marketing the power generated at five powerplants constructed by the Corps of Engineers and the International Boundary and Water Commission, with a total nameplate capacity of 776,500 kilowatts.

Sale of electric power by the Bureau during the year aggregated 25,654,251,471 kilowatt-hours, with revenues from sales totaling $60,153,473.83, as shown on table 6.

Fiscal Year Expansion

During the fiscal year ending June 30, 1957, the installed nameplate capacity of hydroelectric powerplants at Bureau of Reclamation multipurpose projects and at projects for which the Bureau is responsible for marketing the power, increased 237,000 kilowatts over 1956. The projects were:

	Killowatts capacity
Bureau of Reclamation:	
Palisades project (units 2 and 3)	57, 000
U. S. Corps of Engineers:	
Missouri River Basin project (Garrison unit 3)	80, 000
Missouri River Basin project (Gavins Point)	100, 000

TABLE 6.—*Bureau of Reclamation power systems, power sales, and revenues by projects, fiscal year ending June 30, 1957*

Projects	Sales of electric energy, kilowatt-hours [1]	Revenues from sales [1]
Boise	179, 132, 956	$234, 815. 82
Boulder Canyon	2, 641, 458, 899	7, 598, 601. 25
Central Valley	2, 788, 301, 742	11, 159, 579. 40
Columbia Basin [2]	13, 645, 815, 000	12, 629, 813. 02
Eklutna	130, 912, 370	1, 390, 448. 56
Falcon Dam	23, 181, 400	46, 928. 82
Fort Peck	259, 944, 183	1, 120, 762. 03
Hungry Horse [2]	896, 719, 100	3, 563, 114. 30
Minidoka	149, 663, 479	668, 426. 18
Missouri River Basin:		
Eastern Division	2, 411, 796, 063	8, 838, 312. 13
Western Division [3]	1, 162, 680, 702	7, 209, 993. 26
North Platte	94, 778, 065	616, 001. 07
Palisades	98, 695, 273	329, 680. 80
Parker-Davis	1, 056, 587, 345	4, 233, 223. 11
Rio Grande	40, 989, 524	268, 517. 40
Yakima [2]	65, 103, 996	220, 166. 54
Yuma	8, 491, 374	25, 049. 64
Grand total	25, 654, 251, 471	60, 153, 433. 33

[1] Does not include energy sales and revenues in transactions between Bureau projects.

[2] Deliveries to and revenues from Bonneville Power Administration included as follows:

	Kilowatt-hours	
Columbia Basin	13, 081, 048, 951	$12, 347, 430. 00
Hungry Horse	894, 358, 000	3, 553, 000. 00
Yakima	65, 072, 099	220, 000. 00
Total	14, 040, 479, 050	16, 120, 430. 00

[3] Includes systems of Riverton, Shoshone, Colorado-Big Thompson, and Kendrick projects.

Additional Capacity Under Construction

At the end of fiscal year 1957, the Bureau of Reclamation had under construction 10 powerplants, which will have an ultimate installed nameplate capacity of 1,119,150 kilowatts. They are listed below:

State	Plant	Project	River	Nameplate capacity (kw.)
Arizona	Glen Canyon	Colorado River Storage	Colorado	900, 000
Colorado	Big Thompson	Colorado-Big Thompson	Big Thompson	4, 500
Oregon	Green Springs	Rogue River Basin	Emigrant Creek	16, 000
Utah	Flaming Gorge	Colorado River Storage	Green	105, 000
Do	Deer Creek	Provo River Basin	Provo	5, 000
Do	Gateway	Weber	Weber	4, 000
Do	Wanship	do	do	1, 400
Washington	Roza	Yakima-Roza	Yakima-Roza Canal	11, 250
Wyoming	Glendo	Missouri River Basin	North Platte	24, 000
Do	Fremont Canyon	do	do	48, 000

The United States Army Corps of Engineers is proceeding with the construction of its plants in the Missouri River Basin project. The ultimate nameplate capacity of Oahe Powerplant in South Dakota will be 595,000 kilowatts. The Bureau of Reclamation will be the marketing agent for energy generated from this plant as is the case for other plants constructed by the Corps on the Missouri River Basin project.

Hydroelectric Powerplants

The hydroelectric powerplants constructed and operated, under construction and authorized to be constructed by the Bureau of Reclamation and powerplants for which the Bureau is the marketing agent are listed in table 5.

Transmission System

To furnish the electrical energy for the Bureau's projects and to market the power which is surplus to the Bureau's needs, a transmission system including powerplant substations, switchyards, and transmission lines, has been constructed. During the fiscal year ending June 30, 1957, nearly 460 circuit miles of transmission lines were completed to increase the total system to 9,855 circuit miles of line. As of June 30, 1957, the installed transformer capacity of the individual substations operated by the Bureau was approximately 10,000 kilovolt-amperes.

The transmission lines completed in fiscal year 1957 are shown in table 7.

TABLE 7.—*Transmission lines completed during fiscal year 1957*

Project and line	Voltage (kilovolts)	In service date	Circuit miles
Central Valley project: Folsom powerplant to Folsom Prison	4.16	October 1955	1.0
Fort Peck project: Fort Peck powerplant to Whately Substation.	69	August 1956 [a]	(0.8)
Missouri River Basin project:			
Fargo to Grand Forks	115	June 1957	83.0
Edgeley to Groton	115	December 1956	80.5
Watertown to Granite Falls	230	([b])	74.1
Granite Falls to Minnesota Valley	230	([b])	2.6
Kendrick project:			
Alcova Powerplant to Gering	115	([b])	203.6
Alcova Powerplant to Fremont	115	([b])	8.1
Lingle Tap	115	([b])	5.7

[a] Rebuilt line and placed in service on August 26, 1956.
[b] Completed but not in service.

Power Contracts

During fiscal year 1957, there were 133 contracts executed for the delivery of electric power supply. Included among these are:

Number of contracts:
19 with private utilities.
54 with REA cooperatives.
38 with municipalities.
5 with other Federal agencies.
3 with public power districts.
9 with State authorities.
2 with irrigation district.
3 miscellaneous type contracts.

A number of contracts executed were renewals of operating contracts or revisions of existing contracts resulting from changed operating conditions.

The Bureau continued its policy of contracting whenever possible with private utilities, public bodies and cooperatives for wheeling power and energy over existing facilities. The Bureau also entered into several interchange agreements with its customers.

A summary by classification of customers served by Reclamation during fiscal year 1957 is shown in table 8.

The Bureau at the end of fiscal year 1957 had 98 contracts under active negotiation. In this number are included 28 contracts with municipalities, 34 with REA cooperatives, 17 with private utilities, 1 with public power district, 8 with other Federal agencies, 5 with State authorities, 3 with irrigation districts and 2 miscellaneous type contracts. A number of these are to renew the existing contracts, or to revise contracts in existence due to changes in operating conditions.

TABLE 8.—*Summary by classification of customers for 12 months ending June 30, 1957* [1]

Type of customers	Number of customers	Sales of electric energy	Revenues from sales
		Kilowatt-hours	
Privately owned utilities	32	3, 059, 251, 523	$11, 524, 270. 02
Municipal utilities	81	1, 067, 177, 719	5, 232, 645. 52
State Government utilities	15	3, 251, 240, 860	12, 085, 994. 10
Cooperative utilities (Rural Electrification Administration projects)	108	1, 541, 178, 411	8, 411, 752. 95
Other Federal utilities [2]	7	14, 122, 771, 244	16, 482, 202. 51
Residential and domestic	277	5, 353, 930	30, 685. 63
Rural (other than Rural Electrification Administration projects)	8	147, 480	943. 40
Commercial and industrial	23	93, 039, 182	472, 867. 64
Public authorities	65	1, 575, 229, 149	4, 710, 925. 32
Interdepartmental	48	938, 861, 973	1, 201, 146. 24
Total, all customers	664	25, 654, 251, 471	60, 153, 433. 33

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[1] Does not include energy sales and revenues in transactions between Bureau projects.

[2] Totals include 14,040,479,050 kilowatt-hours delivered to Bonneville Power Administration for marketing and $16,120,430.00 in payments by that agency.

ENGINEERING AND CONSTRUCTION

In carrying out its construction activities for fiscal year 1957, the Bureau of Reclamation continued its program of developing water and land resources in the western United States and made important contributions to the expansion of the Nation's resource base. About $130 million were converted into Reclamation works, an investment in dams, powerplants, irrigation canals, pumping plants, electric transmission lines, and other wealth-creating facilities available to serve the West and the Nation.

Construction completed during the year added more than 160,000 acre-feet of storage in new Reclamation project reservoirs, 57,000 kilowatts of hydroelectric generating capacity, 317 miles of canals, aqueducts, and related water conveyance and distribution structures, and 526 miles of large electrical transmission lines.

The total value of all contracts awarded in the fiscal year 1957 amounted to about $299 million comprising the face value of more than 734 separate contracts for construction, materials, equipment, and supplies. Of this total amount, construction contracts accounted for about $289 million or about 97 percent. The 193 construction contracts in force at the end of the year had a total value of about $397 million.

The fiscal year will be remembered for the start of construction in April 1957 of the Glen Canyon Dam and powerplant, major features of the Colorado River Storage project.

The year was highlighted by several other notable construction events. On the Central Valley project in California, construction began on the Trinity Dam, a principal feature in the transbasin diversion of water from the Trinity River watershed to the adjacent Central Valley Basin. On the Solano project, also in California, Monticello Dam was essentially completed and storage began in Lake Berryessa, the new reservoir at the dam.

In Utah, Wanship Dam and 22 miles of the Davis and Weber aqueducts were completed on the Weber Basin project. The Palisades Dam and Powerplant on the Palisades project in Idaho were substantially completed and two of the powerplant's four generators were placed in operation. Missouri River Basin project construction was marked by completion of Pactola Dam in South Dakota and start of Anchor Dam in Wyoming.

Other fiscal year highlights included start of construction of the following important project features: Casitas Dam on the Ventura River Basin project, California; Fremont Canyon powerplant, in Wyoming, and Helena Valley pumping plant, in Montana, both on the Missouri River Basin project; Howard Prairie Dam on the Rogue

Figure 5.—Second highest dam in United States. Glen Canyon Dam, a wall of concrete shaped in an arch standing 700 feet above bedrock will fill this canyon on the Colorado River at the Arizona-Utah border when completed as a major structure in the Colorado River Storage project. Work on the project begun in 1957 will make possible the development of the vast Upper Colorado River Basin's irrigable lands and abundant resources of fuel, oil, minerals, and timber in Colorado, New Mexico, Utah, and Wyoming. Bureau of Reclamation photo.

River Basin project, Oregon; and the Colorado River Bridge on the Colorado River Storage project, Arizona.

Table 8 lists the major construction contracts (more than $1 million) awarded by the Bureau of Reclamation in fiscal year 1957. The outstanding award for the fiscal year was for construction of the Glen Canyon Dam and powerplant, principal features of the Colorado River Storage project in Arizona. The contract is by far the largest contract awarded by the Bureau of Reclamation.

TABLE 9.—*Major Bureau of Reclamation construction contracts awarded in fiscal year 1957*

Feature	Project	Amount of award
Glen Canyon Dam and powerplant	Colorado River Storage	$107,955,522
Trinity Dam	Central Valley	48,928,100
Clear Creek tunnel	do	36,644,556
Fremont Canyon powerplant and power conduit and 3 miles of tunnels.	Missouri River Basin	14,434,000
Casitas Dam	Ventura River	8,576,388
Wahluke siphon, canal, and wasteway	Columbia Basin	6,204,770
108 miles of Shafter-Wasco concrete pipe laterals	Central Valley	5,638,539
Colorado River Bridge	Colorado River Storage	4,139,277
Foundations and steel towers for 165 miles of Fargo-Granite Falls 230-kv. transmission line.	Missouri River Basin	3,097,440
Right diversion tunnel at Glen Canyon Dam	Colorado River Storage	2,452,340
Anchor Dam and 3 miles of access road	Missouri River Basin	2,289,052
12.7 miles of Putah South Canal and 0.5 mile of McCoy Creek wasteway.	Solano	2,143,907
2.6 miles Helena Valley tunnel	Missouri River Basin	2,095,041
Green Springs powerplant, switchyard, steel penstock, and road relocation.	Rogue River Basin	1,802,368
11.8 miles Howard Prairie Canal and Soda Creek Diversion Dam	do	1,636,739
Streets, utilities, residences, and buildings for Trinity Government community facilities.	Central Valley	1,576,589
Surfacing 24.6 miles of access highway to Glen Canyon Dam and construction of Manson Mesa airstrip.	Colorado River Storage	1,517,412
Foundations and steel towers for 76 miles of Utica Junction-Sioux Falls 230-kv. transmission line.	Missouri River Basin	1,316,411
8.5 miles of Putah South Canal	Solano	1,186,826
Earthwork and structures for 4.6 miles of access highway to Glen Canyon Dam.	Colorado River Storage	1,156,244
Completion of Glendo powerplant	Missouri River Basin	1,120,447
Howard Prairie Dam	Rogue River Basin	1,074,345
Helena Valley pumping plant	Missouri River Basin	1,056,383
6.2 miles of Courtland Canal, 15 miles of Courtland laterals, and 13.8 miles of Miller laterals.	do	1,014,168
Earthwork and structures for 20 miles of access highway to Glen Canyon Dam and Waterholes Canyon Bridge.	Colorado River Storage	1,011,820

Other features for which contracts were awarded were Trinity Dam and Clear Creek tunnel on the Central Valley project in California, the Fremont Canyon Powerplant and Power Conduit and Anchor Dam on the Missouri River Basin project in Wyoming, Casitas Dam on the Ventura River Basin project in California, the Wahluke Siphon, canal, and wasteway on the Columbia Basin project in Washington, and the Colorado River Bridge on the Colorado River Storage project in Arizona.

Listed in table 10 are the principal features completed on Bureau of Reclamation projects in fiscal year 1957. The table includes 2 storage dams, 35 pumping plants, 295 miles of canals, laterals, wasteways, and drains, 22 miles of aqueducts, and 526 miles of transmission lines.

TABLE 10.—*Principal features completed on Bureau of Reclamation projects in fiscal year 1957*

Feature	Project	State
168 miles canals, laterals, wasteways, and drains	Columbia Basin	Washington.
20 pumping plants	do	Do.
34 miles of Kennewick main canal and laterals	Yakima	Do.
60-mile 115-kv Palisades-Goshen transmission line.	Palisades	Idaho.
Fish collecting facilities for Delta-Mendota Canal intake.	Central Valley	California.
Diversion tunnel for Trinity Dam	do	Do.
6 miles Shafter-Wasco Irrigation District laterals	do	Do.
6 miles Corning Canal	do	Do.
6 miles Putah South Canal	Solano	Do.
35 miles canals and laterals for Texas Hill and Ralph's Mill areas.	Gila	Arizona.
7 pumping plants for Texas Hill and Ralph's Mill areas.	do	Do.
Wanship Dam	Weber Basin	Utah.
22 miles Davis and Weber Aqueducts	do	Do.
7.6 miles Gateway Canal	do	Do.
Reconductoring 72 miles 115-kv. Elephant Butte-Socorro transmission line.	Rio Grande	New Mexico.
10 miles Atrisco Feeder Canal	Middle Rio Grande	Do.
8 pumping plants for Hanover-Bluff unit	Missouri River Basin	Wyoming.
9 miles of Sargent Canal	do	Nebraska.
13 miles of Kirwin Main Canal	do	Kansas.
Pactola Dam	do	South Dakota.
13 miles Fort Peck-Whately 69-kv. transmission line.	Fort Peck	Montana.
376 miles 115-kv. transmission lines	Missouri River Basin	North Dakota, South Dakota, Wyoming, Nebraska.
77 miles 230-kv. transmission lines	do	South Dakota.

A significant event was start of construction in April 1957 of the second highest dam in the United States, the 700-foot high Glen Canyon Dam on the Glen Canyon Unit of the Colorado River Storage project in northcentral Arizona. The 5,063,000-cubic yard, concrete-arch structure and the 900,000-kilowatt Glen Canyon powerplant are being built on the Colorado River. Glen Canyon reservoir will have a capacity of 28,040,000 acre-feet.

During the fiscal year about 25 miles of highway were placed under construction to provide access to the remote dam site. Construction was also begun on the Colorado River Bridge which will span the Colorado River near the downstream toe of the dam. The steel arch bridge will be the highest and second longest of its type in the United States. Work on the new Government community of Page, Ariz., near the dam site was begun; contracts were awarded for water and sewerage systems and streets for the community.

On the Flaming Gorge unit of the Colorado River Storage project in Utah, preliminary work comprised construction of access roads, community facilities near the dam site, and a timber bridge spanning the Green River. Construction of the concrete-arch dam is planned to begin during fiscal year 1958.

Progress of Construction

On the Columbia Basin project in Washington, the irrigation system was extended to serve an additional 54,000 acres in fiscal year

1957, bringing to a total 301,000 acres available for irrigation. Completed were 168 miles of canals, laterals, wasteways, and drains, and 20 pumping plants. Construction began on the 15-foot diameter, 3-mile long Wahluke siphon, and construction advanced on the Burbank pumping plants No. 2 and 3, and on the Evergreen, Frenchman Springs, and White Bluffs pumping plants.

In Idaho, construction of the 270-foot high, 13,000,000-cubic yard, earthfill Palisades Dam on the Palisades project was essentially completed. The spillway, intake, and powerplant structures were completed and the outlet works were nearing completion at the end of the fiscal year. Two of the 28,500-kilowatt generators in the 114,000-kilowatt Palisades powerplant were placed in operation, and work continued on the installation of the remaining two generators, which are to "go on the line" during fiscal year 1958. Also in Idaho, construction of the American Falls pumping plant on the Michaud Flats project was about three-fourths completed by the end of the fiscal year, and work on the rehabilitation of the face of Black Canyon Dam on the Boise project was completed.

Construction progress in Oregon was noted by the advance to two-thirds completion of the Haystack Dam on the Deschutes project, and initiation of construction of the Howard Prairie Dam and Howard Prairie delivery canal, both on the Rogue River Basin project. Also on the Rogue River Basin project, a contract was awarded for construction of the Green Springs powerplant, which will be the Bureau's highest head powerplant. The 16,000-kilowatt plant will operate under an 1,800-foot head, some 600 feet higher than any existing Reclamation powerplant. Work continued on the rehabilitation and improvement of the existing structures of the Medford Irrigation District, including reconstruction of siphons, canals, and wasteways.

The 11,250-kilowatt Roza powerplant on the Yakima project in Washington was brought to 90 percent of completion at the end of the year. On the same project, alterations to the Prosser Diversion Dam were completed; several sections of the Kennewick main canal and laterals were also completed.

A major Bureau of Reclamation construction undertaking during the year was start of construction of the Trinity Dam on the Trinity River Division of the Central Valley project in California. The 510-foot high, 29,000,000-cubic yard dam will be one of the world's highest earthfill dams. The dam and other Division structures will ultimately make possible the average annual transbasin diversion of 865,000 acre-feet of surplus waters from the Trinity River watershed to the Central Valley Basin. Also placed under construction during the year was another major Division feature, the Clear Creek tunnel. The 10.8-mile long, 17.5-foot diameter tunnel will be the second longest tunnel constructed on a Reclamation project.

Other construction activities on the Central Valley project included completion of excavation of the 33-foot diameter diversion tunnel at Trinity Dam; completion of 6 miles of concrete pipe laterals for the Shafter-Wasco Irrigation District on the Friant-Kern Canal Distribution System; completion of a 6-mile section of the Corning Canal; and completion of the novel fish-collecting facilities at the intake to the Delta-Mendota Canal. Construction began on 108 miles of concrete pipe laterals for the Shafter-Wasco Irrigation District.

Dam construction was notable on three other projects in California. On the Solano project, the 304-foot high, concrete-arch Monticello Dam was essentially completed at year's end, and reservoir storage behind the dam was begun. Putah Diversion Dam on the same project was about 80 percent completed at the end of the year. The 285-foot high, 9,000,000-cubic-yard, earthfill Casitas Dam on the Ventura River project was placed under construction during the year. On the Santa Maria project, construction of the Vaquero Dam neared the midway point of completion; the dam is an earthfill structure having a height of 241 feet and a volume of about 5,830,000 cubic yards.

Good progress was made on construction of the Palo Verde Diversion Dam on the Colorado River between California and Arizona. This Palo Verde Diversion Project feature was about 75 percent completed by the end of the fiscal year. Work on the Gila project in Arizona was noted for completion of the irrigation distribution systems for the Texas Hill and Ralph's Mill areas of the Wellton-Mohawk Division.

In Utah, the earthfill Wanship Dam on the Weber Basin project was completed and the Slaterville Diversion Dam was essentially completed by year's end. The 5-mile long Weber aqueduct and the first 17-mile long section of the Davis aqueduct were completed. All structures and embankment for enlargement of the Pineview Dam were completed and installation of gates and equipment were essentially completed. Construction was started in April 1957 on the 1,400-kilowatt Wanship powerplant and the 4,000-kilowatt Gateway powerplant.

On the Provo River project in Utah, construction of the 5,000-kilowatt Deer Creek powerplant was brought to 60 percent completion.

In New Mexico, channelization of 17 miles of the Rio Grande River on the Middle Rio Grande project was completed during the year and an additional 15-mile reach of channelization was substantially completed. Also completed on the project were 10 miles of the Atrisco feeder canal, rehabilitation of the San Acacia diversion dam, and rehabilitation of the Belen unit 1 irrigation system and units 1 and 2 of the Socorro irrigation system.

Construction progress on the Missouri River Basin project was noted by completion of the 230-foot high Pactola Dam, an earthfill structure in South Dakota. In Wyoming, construction began on the 200-foot high, concrete-arch Anchor Dam. Work was also begun on the earthfill Helena Valley Dam and Helena Valley pumping plant in Montana. Construction of the 3-mile-long Helena Valley tunnel was about 30 percent completed by the end of the fiscal year.

Work on the Transmission Division of the Missouri River Basin project in North and South Dakota included completion of the 80-mile Fargo-Grand Forks 115-kv. transmission line and the 80-mile Edgeley-Groton 115-kv. line, and stringing of the last section of the 204-mile, 230-kv. Big Bend-Granite Falls transmission line. Contracts were awarded for start of construction of the 165-mile, 230-kv. Fargo-Granite Falls transmission line and the 67-mile, 230-kv. Utica Junction-Sioux Falls line. In Wyoming and Nebraska, the 201-mile, 115-kv. Alcova-Gering transmission line was completed.

In Wyoming the placing of the embankment for the earthfill Glendo Dam was 94 percent completed by the end of the fiscal year and will be completed early in fiscal year 1958. Construction continued on the 24,000-kilowatt Glendo powerplant. Work was started on the 48,000-kilowatt Fremont Canyon powerplant and power conduit. In the same State the Hanover and Bluff pumping plants and associated lateral systems were completed and placed in service.

In the Nebraska and Kansas areas of the Missouri River Basin project, work was continued on development of the project's irrigation facilities. Lovewell Dam on the Bostwick Division in Kansas neared completion and will be finished early in the next fiscal year. An 8-mile reach of the Courtland Canal, adjoining the outlet works of Lovewell Dam, was completed. Construction began on the 10-mile Courtland West Canal and lateral system. On the Frenchman-Cambridge Division the first 10-mile section of the Upper Meeker Canal connecting with the outlet works of Trenton Dam was essentially completed, and the 7½-mile second section of the canal and associated laterals and drains were about 50 percent completed. Completed on the Sargent unit was a 9-mile section of the Sargent Canal; work on the last 19-mile section of the Sargeant Canal and lateral system was brought to about 50 percent of completion. The 13-mile Kirwin Main Canal on the Kirwin unit was completed, and work continued on the 16-mile Kirwin South Canal.

Construction began in June 1957 on the 4,500-kilowatt Big Thompson powerplant on the Colorado-Big Thompson project in Colorado. The powerplant will bring the planned development of the project to completion.

Design Activities and Developments

Greater use of subprofessional staff members in routine design assignments, improved design techniques and greater utilization of automatic computing devices in design work resulted in design schedules being efficiently and promptly met despite difficulties imposed by a shortage of trained design engineers. Design specifications for 116 construction contracts and 91 major supply contracts were completed. The average cost for these engineering services as related to the overall Bureau of Reclamation construction and rehabilitation program for the 1957 fiscal year was 5.3 percent.

Use of an electronic digital computer greatly speeded up calculations of earthwork quantities in canal design. Excavation and compacted embankment quantities for a total of 122 miles of two canals were computed from original field data at a rate of up to 600 cross sections an hour. The calculations, which included a total of 4,000 cross sections and represented 6.4 million cubic yards of excavation and 1.6 million cubic yards of compacted embankments, were completed in 9 hours. Under conventional methods, the same computations would have required 4 man-months of design work.

Automatic machine methods for computation were similarly used in dams designed to effect considerable economy. For one phase of analysis of the stresses in Glen Canyon Dam, computations were completed on an automatic computer in less than 2 hours. The same analysis would have required about 40 man-days by conventional methods.

Designs for modifications and additions to the headworks and siphon spillway of the Chandler power and pumping plant on the Yakima project in Washington, included electroconductive rubber heating blankets to be installed in the plant's siphon spillway. The blankets have flexible rubber facings which hermetically seal a waterproof heating element. This was the Bureau's first use of the blankets to prevent adherence of ice to critical surfaces of powerplant appurtenances.

Use was made during the year of a new geophysical field technique at the Glen Canyon and Flaming Gorge dam sites. By detonating a small explosive charge on the rock at the dam sites, the subsequent vibrations in the rock, analyzed by geophysical seismic equipment, provided a means of measuring the elasticity and strength of the foundation and abutment rock under the influence of the loads imposed by the dams and the impounded water.

Three Bureau inventions were patented during the fiscal year. One invention permits precipitation measurements to be automatically transmitted by radio from unattended precipitation recording stations. Also patented was a device for detecting small amounts of water in insulating oils for electrical equipment, and an invention which utilizes magnetic tape for power system oscillographic recording, rather than photographic film.

Considerable progress was made in investigating the possibilities of controlling evaporation from open reservoirs by the use of a monomolecular film—a floating invisible shield between air and water. A method was developed to detect the presence of monomolecular layers on reservoirs. An investigation of methods of applying hexadecanol was begun at Rattlesnake Reservoir on the Colorado-Big Thompson project in Colorado, preliminary to full-scale monomolecular layer experiments planned for Lake Hefner at Oklahoma City. Preliminary studies indicated that the toxicity of hexadecanol (cetyl alcohol) to specific elements of aquatic life, such as plants, fish, and waterfowl, would be insignificant. In a joint program conducted on a small lake in Oklahoma City, a 2-month trial of hexadecanol indicated no significant change in water quality or undesirable effects on lake biology.

In concrete research, a long-term study of the resistance of concrete to destructive sulfate attack confirmed that low tricalcium aluminate content in cement is the major factor contributing to sulfate resistance. The study also indicated that sulfate resistance for all cement types is increased by a corresponding decrease in the water-cement ratio. Research into the effect of vibration of air-entrained concrete disclosed that proper air content and thorough compaction are essential to optimum freezing and thawing resistance of the concrete.

Initial work was completed to find practicable methods of improving concrete by modifying the particle shape of the sand to be used in concrete. Treatment of a sand in the laboratory processing machines resulted in as much as 15 percent reduction in water requirement and a corresponding reduction in cement.

Hydraulic laboratory model studies of the Glen Canyon Dam spillways indicated that the preliminary design of the approach channels at the canyon edge could be reduced in width by 210 feet, which in turn will reduce the rock excavation by 440,000 cubic yards. Hydraulic studies for Trinity Dam showed that the lengths of the hollow-jet valve stilling basin and the center training wall could be considerably reduced and would result in better performance at reduced cost. Research into a high pressure, closed conduit indicated that cavitation damage to the conduit downstream from a partly opened gate valve could be virtually eliminated by increasing the diameter of the conduit downstream from the valve to 1.75 times the diameter of the valve.

As part of the Bureau's lower-cost canal lining program, laboratory studies and field trials were continued on sediment, soil-cement, earth, asphalt, plastic, and other types of linings for irrigation canals. It was found that the addition of only 2 to 4 percent of cement to a sandy loess soil greatly increased erosion resistance, freezing and thawing durability, and unconfined compressive strengths.

New specifications were prepared for sediment lining and prefabricated asphaltic liners. Installations were made for field permeability tests to determine the effects of climatic conditions on compacted earth linings, and electrical methods for locating subsurface seepage paths from a canal were studied. A chemical test was developed for the rapid determination of the cement content of soil-cement mixture for canal lining; the test is to be used as a control during mixing operations.

In soils research, studies on stabilizing clay canal slopes indicated that a pronounced reduction in expansiveness is achieved by mixing 4 percent of hydrated lime or portland cement into the clay. Experimental stabilization of the slopes of an unlined reach of the Friant-Kern Canal, where expansive clay has caused sloughing, was begun by employing electrochemical techniques.

Research completed on the in-place measurement of the sediment density at Angostura Reservoir with an atomic radiation device showed the method to be feasible. The device was developed and tested for the Sedimentation Subcommittee of the Interagency Committee on Water Resources as a possible supplement to conventional sediment survey methods that involve removal and laboratory testing of sediment samples.

The measurements were made using gamma rays which radiated into the sediment from a piece of radioactive material in a probe that was lowered into the reservoir. The amount of scattering of the rays caused by the sediment was then recorded, giving a measure of the sediment density.

In weed control research, several samples of emulsifying agents were evaluated for suitability in producing stability in emulsions of aromatic solvent water weed killers. Further development was made in the test method devised for the evaluation of emulsifying agents. Equipment and procedures were developed to evaluate the efficacy of weed-killing chemicals under flowing water conditions. Specifications for purchasing aromatic solvent water weed killers were revised and improved.

During the year 116 laboratory reports were issued covering the subjects of research and testing of concrete materials, hydraulic laboratory studies, earth materials investigations, research in bituminous materials, structural studies, and protective coatings investigations.

Construction Costs

Construction costs on Bureau of Reclamation projects increased about 6.5 percent during fiscal year 1957. This increase was somewhat less than in fiscal year 1956, when construction costs on Reclamation projects increased about 8.5 percent.

Bidding interest in all types of reclamation construction work showed a slight increase over the preceding year, rising from an average of 5.4 bids per construction schedule in fiscal year 1956, to about 5.8 bids in fiscal year 1957.

The following table shows cost indexes for Bureau of Reclamation construction work based on the combined costs of materials and labor supplied by contractors and materials and labor supplied by the Government.

TABLE 11.—*Bureau of Reclamation construction indexes, fiscal year 1957*

Cost indexes based on January 1940 costs=1.00	July 1956	January 1957	June 1957
Dams:			
Earth	2.26	2.30	2.38
Concrete	2.30	2.34	2.41
Pumping plants:			
Building and equipment	2.82	2.95	2.99
Structures and improvements*	2.96	3.03	3.05
Equipment	2.62	2.82	2.86
Pumps and prime movers	2.77	2.95	2.99
Accessory electric and miscellaneous equipment	2.42	2.62	2.66
Steel penstocks and discharge pipes	3.33	3.62	3.66
Canals and conduits:			
Canals	2.44	2.55	2.59
Conduits (tunnels, free flow, concrete lined)	2.78	2.80	2.85
Laterals and drains	2.90	3.05	3.17
Powerplants, hydro:			
Building and equipment	2.71	2.85	2.89
Structures and improvements*	2.92	2.96	2.99
Equipment	2.64	2.80	2.84
Turbines and generators	2.63	2.83	2.84
Accessory electrical equipment	2.47	2.65	2.69
Miscellaneous equipment	2.61	2.79	2.81
Concrete pipelines	2.21	2.32	2.32
Transmission switchyards and substations	2.72	2.94	2.96
Transmission lines (wood pole 115-kv.)	2.20	2.20	2.20
Transmission lines (steel tower 230-kv.)	2.54	2.62	2.65
Permanent general property buildings	2.92	2.94	2.94
Roads and bridges:			
Primary roads	2.41	2.48	2.56
Secondary roads, unsurfaced	2.14	2.24	2.34
Bridges (steel)	3.05	3.20	3.23
Composite index	2.52	2.63	2.69

*Indexes for structures and improvements on pumping plants and powerplants are based on a reinforced concrete structure.

Foreign Manufacturers

Twenty-six contracts, principally for electrical equipment, were awarded to companies offering equipment manufactured outside the United States. These contracts, which totaled $1,387,693, included 11 English, 8 Italian, 3 Swiss, 1 West Germany, and 3 Austrian firms. A differential of 6 percent was added to all foreign bids before comparison was made with domestic bids, in accordance with departmental regulations applying to determinations under the "Buy American Act." An additional 6 percent differential was added if the low domestic bidder indicated that equipment or materials would be produced in an area of substantial labor surplus, as determined by the Secretary of Labor.

TABLE 12.—*Bureau of Reclamation storage dams, June 30, 1957*

State and project	Name of dam	River	Type	Capacity (acre feet)	Height (feet)	Length (feet)	Volume (cubic yards)	Year
Alaska:								
Eklutna	Eklutna	Eklutna Creek	Earth	182,100	26	555	5,000	[2] 1955
Arizona:								
Colorado River Storage	Glen Canyon	Colorado	Concrete arch	28,040,000	700	1,580	5,063,000	(5)
Salt River	Bartlett	Verde	Concrete multiple arch	179,500	287	800	182,000	1939
	Horse Mesa	Salt	Concrete arch	245,100	305	660	162,000	[2] 1937
	Mormon Flat	do	do	57,900	224	380	59,900	[2] 1938
	Roosevelt	do	Masonry arch	1,381,600	280	723	355,800	1911
	Stewart Mountain	do	Concrete arch	69,800	207	1,260	120,500	[2] 1936
Arizona-California:								
Parker-Davis	Parker [3]	Colorado	do	716,600	320	856	380,000	1938
Arizona-Nevada:								
Boulder Canyon	Hoover	do	Concrete arch-gravity	29,827,000	726	1,244	4,400,000	1936
Parker-Davis	Davis	do	Earth and rock	1,818,300	200	1,600	4,357,500	1950
California:								
Cachuma	Cachuma	Santa Ynez	Earth	204,900	275	3,289	6,695,272	1953
	Glen Anne	Glen Anne Canyon Creek, West Fork.	do	500	102	240	323,343	1953
	Lauro	Diablo Creek	do	642	110	540	499,223	1952
Central Valley	Folsom [4]	American	Concrete gravity, embankment wings.	1,010,300	340	10,200	9,010,000	1955
	Friant [3]	San Joaquin	Concrete gravity	520,500	319	3,488	2,135,000	1942
	Keswick	Sacramento	Concrete gravity, embankment wings.	23,800	159	1,046	197,000	1950
	Martinez	Offstream	Earth	265	62	1,200	183,450	1947
	Nimbus	American	Concrete gravity	8,800	76	1,093	121,065	1955
	Shasta	Sacramento	Concrete curved-gravity, embankment wing.	4,500,000	602	3,460	8,711,000	1945
	Sly Park Main Dam	Sly Park Creek	Earth	41,000	190	760	1,290,600	1955
	Sly Park Saddle Dam	Offstream	do		130	600		1955
	Trinity	Trinity	Earth, gravel and rock	2,500,000	510	2,450	29,100,000	(5)
Orland	East Park	Little Stony Creek	Concrete arch-gravity	50,900	139	266	12,202	1910
	Stony Gorge	Stony Creek	Concrete slab-and-buttress	[1] 50,000	139	868	43,135	1928
Santa Maria	Vaquero	Cuyama	Earth	239,000	241	1,800	5,833,000	(5)
Solano	Monticello	Putah Creek	Concrete arch	1,600,000	304	1,010	325,000	(5)
Colorado:								
Collbran	Vega	Plateau Creek	Earth and rock	33,800	150	2,035	920,000	(5)
Colorado-Big Thompson	Carter Lake No. 1	Offstream	Earth	112,200	214	1,235	2,547,388	1952
	Carter Lake No. 2	do	do		75	1,150	321,174	
	Carter Lake No. 3	do	do		55	1,425	211,852	
	Dixon Canyon	do	do	151,800	240	1,265	2,961,350	1949
	Horsetooth	do	do		155	1,840	[9] 1,871,000	1949
	Soldier Canyon	do	do		226	1,438	3,212,000	1949
	Spring Canyon	do	do		220	1,120	2,095,000	1949

	Flatiron	Chimney Hollow Creek	do	760	86	1,725	381,500	1953
	Granby	Colorado	do	539,800	298	861	2,974,000	1950
	Green Mountain	Blue	do	154,600	309	1,150	4,360,000	1943
	Marys Lake Dike No. 1	Offstream	do	900	29	820	90,300	1949
	Marys Lake Dike No. 2	do	do		35	950		1949
	Olympus	Big Thompson	Earth, concrete overflow section	3,100	70	1,951	311,600	1949
	Rattlesnake	Rattlesnake Creek	Earth	2,180	130	1,100	432,000	1952
	Shadow Mountain	Colorado	do	18,400	63	3,077	[9] 167,000	1946
	Willow Creek	Willow Creek	do	10,600	127	1,100	392,400	1953
Fruitgrowers Dam	Fruitgrowers	Alfalfa Run	do	4,600	55	1,520	135,500	1938
Mancos	Jackson Gulch	Offstream	do	10,000	180	1,900	1,710,000	1949
Pine River	Vallecito	Los Pinos	do	129,700	162	4,010	3,738,000	1941
San Luis Valley	Platoro	Conejos	do	60,000	165	[9] 1,475	[9] 912,000	1951
Uncompahgre	Taylor Park	Taylor	do	[1] 106,200	206	675	1,115,000	1937
Idaho-Oregon:								
Boise	Anderson Ranch	Boise, South Fork	Earth	493,200	456	1,350	9,653,000	1950
	Arrowrock	Boise	Concrete arch-gravity	286,600	350	1,150	635,969	1915
	Cascade	Payette, North Fork	Earth	704,100	107	785	395,000	1948
	Deadwood	Deadwood	Concrete arch-gravity	161,900	165	749	56,360	1931
	Deer Flat, upper	Offstream	Earth	190,100	74	4,000	1,245,000	1908
	Deer Flat, lower	do	do		46	7,200	1,240,000	1908
Idaho-Wyoming:								
Minidoka	American Falls	Snake	Concrete-gravity embankment wings	[1] 1,700,000	94	5,227	313,600	1927
	Grassy Lake	Grassy Creek	Earth and rock	15,400	118	1,170	539,000	1939
	Island Park	Snake, Henrys Fork	do	127,600	91	9,448	564,000	1938
	Jackson Lake	Snake	Concrete gravity, embankment wings.	847,000	78	4,920	491,700	1911
	Minidoka [3]	do	Earth and rock, concrete powerhouse, spillway and headgate sections.	210,000	86	4,475	257,300	1906
Palisades	Palisades	Snake, South Fork	Earth	1,402,000	270	2,100	13,571,000	(5)
Kansas:								
Cedar Bluff Unit (Missouri River Basin).	Cedar Bluff	Smoky Hill	do	377,000	202	12,560	8,490,000	1951
Kirwin Unit (Missouri River Basin).	Kirwin	Solomon, North Fork	do	314,600	169	12,646	9,537,000	1955
Webster Unit (Missouri River Basin).	Webster	Solomon, South Fork	do	260,700	154	10,600	8,145,000	1956
Kansas-Colorado:								
St. Francis Unit (MRB)	Bonny	Republican, South Fork	do	170,200	158	9,200	8,853,000	1951
Kansas-Nebraska:								
Bostwick Division (MRB).	Lovewell	White Rock Creek	do	94,000	93	8,500	3,190,000	(5)
Montana:								
Bitter Root	Como	Rock Creek	do	36,600	65	2,550	1,114,000	[2] 1954
Canyon Ferry Unit (Missouri River Basin).	Canyon Ferry	Missouri River	Concrete gravity	2,051,000	225	1,000	414,000	1954
Helena Valley Unit (Missouri River Basin).	Helena Valley	Offstream	Earth	10,560	91	2,880	303,000	(5)
Hungry Horse	Hungry Horse	Flathead, South Fork	Concrete arch	3,468,000	564	2,115	3,068,200	1953
Huntley	Anita	Offstream	Earth	400	42	1,050	142,800	1937

See footnotes at end of table.

TABLE 12.—*Bureau of Reclamation storage dams, June 30, 1957*—Continued

State and project	Name of dam	River	Type	Capacity (acre feet)	Height (feet)	Length (feet)	Volume (cubic yards)	Year
Montana—Continued								
Lower Marias Unit (Missouri River Basin).	Tiber	Marias	Earth	1,337,000	205	4,300	9,290,000	1956
	Tiber Dike	do	do		60	17,000	1,740,000	1956
Milk River	Fresno	Milk	do	129,100	111	2,070	2,105,000	1939
	Nelson Dikes	Offstream	do	85,500	28	9,900	232,600	1915
	Sherburne Lake	Swift Current Creek	do	66,100	96	1,086	227,600	1921
Sun River	Gibson	Sun, North Fork	Concrete arch	105,000	199	960	167,530	1929
	Pishkun Dikes	Offstream	Earth	46,300	12–50	[11] 9,050	[11] 599,300	1921
	Willow Creek	Willow Creek	do	32,400	93	650	275,000	1911
Nebraska:								
Frenchman-Cambridge Division (Missouri River Basin).	Enders	Frenchman Creek	Earth	74,500	134	2,603	1,951,000	1950
	Medicine Creek	Medicine Creek	do	90,900	165	5,665	2,676,000	1949
	Trenton	Republican	do	254,000	144	8,600	7,737,000	1953
Mirage Flats	Box Butte	Niobrara	do	31,100	87	5,508	1,422,000	1946
Nebraska-Wyoming:								
North Platte	Guernsey	North Platte	do	44,800	135	560	586,000	1927
	Lake Alice, upper	Offstream	do	11,200	30	3,100	240,600	1912
	Lake Alice, lower	do	do		23	2,550	119,000	1913
	Minatare	do	Earth and gravel, concrete-faced	62,200	63	3,700	169,100	1915
	Pathfinder	North Platte	Masonry arch	1,015,900	214	432	65,700	1909
	Pathfinder Dike	do	Earth		38	1,650	152,000	1909
Nevada:								
Humboldt	Rye Patch	Humboldt	do	[1] 190,000	75	914	356,000	1936
Nevada-California:								
Newlands	Lahontan	Carson	Earth and gravel	290,900	162	5,400	733,100	1915
	Lake Tahoe [3]	Truckee	Concrete slab-and-buttress, sluiceway regulator.	[1] 732,000	16	109	425	1913
Truckee Storage	Boca	Little Truckee	Earth	41,100	116	1,629	912,000	1939
New Mexico:								
Carlsbad	Alamogordo	Pecos	do	122,100	164	3,084	2,250,000	1937
	Avalon [3]	do	Earth and rock, concrete core wall	6,000	58	1,025	202,300	1907
	McMillan	do	Earth and rock	32,300	57	2,114	234,000	[2] 1908
Middle Rio Grande	El Vado	Rio Chama	Earth, steel-faced	194,500	175	1,300	608,000	[2] 1955
Vermejo	Dam No. 2	Offstream	Earth	2,900	12	10,730	206,000	1954
	Dam No. 13	do	do	5,000	32	8,237	248,000	1954
	Stubblefield	do	do	16,200	47	[9] 15,569	[9] 827,000	1954
New Mexico-Texas:								
Rio Grande	Caballo [3]	Rio Grande	do	340,900	112	4,558	1,244,000	1938
	Elephant Butte	do	Concrete straight gravity	2,185,400	301	1,674	629,500	1916
	Picacho North	Picacho Arroyo, North Branch.	Earth	[6] 790	45	1,600	148,600	1953
	Picacho South	Picacho Arroyo, South Branch.	do	[6] 460	29	1,680	85,940	1954

North Dakota:								
Dickinson unit (Missouri River Basin).	Dickinson	Heart River	do	16,500	62	2,275	324,000	1950
Heart Butte unit (Missouri River Basin).	Heart Butte	do	do	225,500	142	1,850	1,140,000	1949
Jamestown unit (Missouri River Basin).	Jamestown	James	do	230,000	110	1,418	963,000	1953
Oklahoma:								
W. C. Austin	Altus [3]	Red, North Fork	Concrete gravity, masonry-faced	164,300	110	1,112	70,170	1945
Oregon:								
Baker	Thief Valley	Powder	Concrete slab-and-buttress	17,600	73	390	6,290	1932
Burnt River	Unity	Burnt	Earth and rock	25,800	83	694	253,600	1938
Crescent Lake	Crescent Lake	Crescent Lake	Earth	86,000	40	450	19,000	1956
Deschutes	Crane Prairie	Deschutes	Earth and rock	55,300	36	285	29,700	1940
	Haystack	Offstream	Earth	6,600	105	1,200	535,000	(5)
	Wickiup	Deschutes	do	187,300	100	13,860	[9] 1,852,000	1949
Ochoco	Ochoco	Ochoco Creek	do	47,500	125	1,350	750,000	[2] 1950
Rogue River Basin	Four Mile Lake	Four Mile Lake	Rock, concrete facing	19,500	25	660	2,000	[2] 1956
	Fish Lake	Fish Lake	Earth and rock	7,980	50	1,150	127,800	[2] 1956
	Howard Prairie	Beaver Creek	Earth	62,000	88	990	403,000	(5)
Umatilla	Cold Springs	Offstream	do	50,000	98	3,450	793,400	1908
	McKay	McKay Creek	Gravel, concrete-faced	73,800	165	2,700	2,364,000	1927
Vale	Agency Valley	Malheur, North Fork	Earth	60,000	110	1,850	646,000	1935
	Warm Springs	Malheur, Middle Fork	Concrete arch	192,400	106	469	19,500	[7] 1919
Oregon-California:								
Klamath	Clear Lake	Lost	Earth and rock	526,800	39	840	63,400	1910
	Gerber	Miller Creek	Concrete arch	94,300	88	485	11,890	1925
	Link River	Link	Reinforced concrete slab	873,300	22	435	2,200	1921
Oregon-Idaho:								
Owyhee	Owyhee [3]	Owyhee	Concrete arch-gravity, straight gravity right wing.	1,120,000	417	833	537,500	1932
South Dakota:								
Angostura unit (MRB)	Angostura	Cheyenne	Concrete gravity, embankment wing	160,000	193	2,030	850,000	1949
Belle Fourche	Belle Fourche	Owl Creek	Earth, concrete-faced	192,000	122	6,262	1,783,000	1911
Rapid Valley	Deerfield	Castle Creek	Earth	15,700	133	825	607,400	1946
Rapid Valley unit (Missouri River Basin).	Pactola	Rapid Creek	do	99,000	230	1,255	4,225,000	1956
Shadehill unit (Missouri River Basin).	Shadehill	Grand	do	358,000	145	12,843	3,500,000	1951
Texas:								
Colorado River	Marshall Ford	Colorado (Texas)	Concrete straight gravity, embankment wings.	2,200,200	278	5,093	3,389,000	1942
Utah:								
Hyrum	Hyrum [3]	Little Bear	Earth	18,800	116	540	430,000	1935
Moon Lake	Midview	Offstream	do	[1] 5,800	54	663	139,000	1937
	Midview Dike	do	do		21	2,575	86,000	1937
	Moon Lake	Lake Fork, West Fork	do	49,500	101	1,108	513,000	1938
Newton	Newton	Clarkston Creek	do	5,600	101	3,340	410,000	1946
Provo River	Deer Creek	Provo	do	152,600	235	1,304	2,809,800	1941
Scofield	Scofield	Price	do	73,600	125	575	203,700	1946

See footnotes at end of table.

TABLE 12.—*Bureau of Reclamation storage dams, June 30, 1957*—Continued

State and project	Name of dam	River	Type	Capacity (acre feet)	Height (feet)	Length (feet)	Volume (cubic yards)	Year
Utah—Continued								
Strawberry Valley	Strawberry	Strawberry	Earth, concrete core wall	283,000	72	490	118,000	1913
	Indian Creek Dike	do	do		37	1,311	114,000	1913
Weber Basin	Pineview [10]	Ogden	do	109,950	132	600	418,000	1937
	Wanship	Weber	Earth	60,000	156	2,010	3,021,000	1957
Weber River	Echo	do	do	[1] 73,900	158	1,887	1,540,000	1931
Washington:								
Columbia Basin	Dry Falls	Offstream	do	1,275,100	123	9,800	1,658,000	1949
	North	do	do		145	1,450	1,473,000	1954
	Grand Coulee	Columbia	Concrete gravity	9,402,000	550	4,173	10,585,000	1921
	Long Lake	Offstream	Earth	62,720	130	1,960	1,462,000	1948
	O'Sullivan	Lower Crab Creek	do	[8] 615,600	200	19,000	8,753,000	1949
	Soda Lake Dike	Soda Lake	do		61	1,750	216,000	1952
Okanogan	Conconully	Salmon Creek	do	13,000	70	1,000	359,000	1910
	Salmon Lake	Offstream	do	10,500	42	1,260	195,000	1921
Yakima	Bumping Lake [3]	Bumping	do	37,300	45	2,925	252,600	1910
	Clear Creek [3]	Tieton, North Fork	Concrete arch	5,300	84	404	5,770	1914
	Cle Elum	Cle Elum	Earth	529,200	160	1,801	1,411,000	1933
	Kachess	Kachess	Earth and gravel	[1] 239,000	114	1,400	200,000	1912
	Keechelus	Yakima	do	170,500	103	6,550	683,500	1917
	Tieton	Tieton	Earth, concrete core wall	198,000	235	920	2,049,000	1925
Wyoming:								
Boysen unit (MRB)	Boysen	Big Horn	Earth and rock	970,000	220	1,143	1,527,400	1952
Eden	Big Sandy	Big Sandy Creek	do	39,700	85	2,350	840,000	1952
Glendo unit (Missouri River Basin).	Glendo	North Platte	Earth	735,000	212	1,947	3,051,000	(5)
Kendrick	Alcova [3]	do	do	190,500	265	763	1,635,000	1936
	Seminoe	do	Concrete arch	1,012,000	295	530	210,000	1939
Keyhole unit (MRB)	Keyhole	Belle Fourche	Earth	200,000	168	3,420	1,335,000	1952
Kortes unit (Missouri River Basin).	Kortes	North Platte	Concrete straight gravity	4,700	244	440	147,000	1951
Owl Creek unit (Missouri River Basin).	Anchor	Owl Creek, South Fork	Concrete arch	17,300	200	550	63,000	(5)
Riverton	Bull Lake	Bull Lake Creek	Earth	[1] 152,000	81	3,456	819,600	1938
	Pilot Butte Dam No. 1	Offstream	do	36,960	51	1,300	135,300	1926
	Pilot Butte Dam No. 2	do	do		25	1,200	50,500	1926
	Pilot Butte Dam No. 3	do	do		12	3,400	19,200	1926

Wyoming-Montana:								
Shoshone	Buffalo Bill	Shoshone	Concrete arch	439,800	325	200	82,900	1910
	Deaver	Offstream	Earth	680	14	1,300	30,300	1918
	Ralston	do	do	1,500	35	2,200	24,700	1908

DEFINITIONS

Capacity: Total reservoir storage to highest controlled water surface, except where indicated by footnote 1.

Height: Distance between lowest point in foundation and normal crest of dam.

Length: Extent of barrier in dam and integral features constructed between natural abutments.

Volume: Space occupied by all material in dam and its appurtenant features.

Year: Date original construction was completed by Bureau of Reclamation, except as indicated in footnote 2.

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[1] Live storage—dead storage not evaluated.

[2] Non-Reclamation construction. Date is of supplemental construction by Bureau of Reclamation.

[3] Storage and diversion.

[4] Dam constructed by U. S. Army Corps of Engineers, reservoir operated by Bureau of Reclamation.

[5] Under construction.

[6] For flood retention only.

[7] Non-Reclamation construction. Bureau purchased half-interest in 1926.

[8] Greater part of active storage behind O'Sullivan provided through wasteways from primary irrigation features of project.

[9] Includes dike.

[10] Constructed under Ogden River project, enlarged under Weber Basin project.

[11] Total eight dikes.

TABLE 13.—*Bureau of Reclamation diversion dams, June 30, 1957*

State and project	Name of dam	River	Type	Capacity (acre-feet)	Height (feet)	Length (feet)	Volume (cubic yards)	Year
Arizona:								
Salt River	Granite Reef	Salt	Concrete ogee weir, embankment wings.	3,600	18	1,128	35,000	1908
	Joint Head	do	Concrete weir, embankment wing	200	4	2,600	5,400	1914
	Power Canal	do	do	220	8	862	16,000	1906
Arizona-California:								
Gila and Boulder Canyon, All American Canal System.	Imperial	Colorado	Concrete slab-and-buttress, overflow section.	17,155	23	3,475	196,790	1938
Palo Verde	Palo Verde	do	Earth, concrete gate structure	1,800	15	1,300	214,500	(1)
Yuma	Laguna	do	Rockfill weir, concrete-surfaced	2,000	10	4,780	486,800	1909
California:								
Central Valley	Camp Creek	Camp Creek	Concrete weir	500	20	119	1,721	1953
Orland	North	Stony Creek	Concrete weir, removable crest	125	3	375	650	1913
	Rainbow	do	Concrete arch, overflow	200	29	271	1,777	1914
	South	do	Concrete weir	225	2	895	3,600	1916
Solano	Putah	Putah Creek	Concrete and earth	956	25	900	32,600	(1)
Colorado:								
Colorado-Big Thompson	East Portal	Wind	Rock, concrete core wall	550	10	245		1947
	Horsetooth Supply	Big Thompson	Concrete box	600	8	90	1,300	1950
	Little Hell Creek	Little Hell Creek	Earth and rock	550	33	220	10,000	1952
	North Poudre Supply Canal.	Cache la Poudre	Concrete weir, embankment wing	250	6	200	1,300	1952
	Pole Hill Afterbay	Little Hell Creek	Earth and rock	550	21	220	6,000	1953
	South Platte Supply Canal.	Boulder Creek	Concrete weir	230	5	64		1956
	Willow Creek Pump Forebay.	Offstream	Earth and rock	450	11	580	15,000	1953
Fruitgrowers Dam	Dry Creek	Dry Creek	Concrete, overflow weir	100	5	36	242	1940
Grand Valley	Grand Valley	Colorado	Concrete ogee weir	1,675	14	546	17,990	1916
Paonia	Fire Mountain	Gunnison, North Fork	Timber sheet piling, rockfill	180	11	187	2,458	1950
Uncompahgre	East Canal	Uncompahgre	Concrete weir, embankment wing	330	8	764	1,009	[5] 1915
	Garnet	do	Rockfill weir, concrete-surfaced	75	4	[3] 75	500	[2] 1914
	Gunnison	Gunnison	Timber-crib weir, concrete wings, removable crest.	1,000	10	244	3,200	1912
	Ironstone	Uncompahgre	Concrete gate structure, concrete wing.	370	8	[3] 30	155	[2] 1915
	Loutsenhizer	do	Pile and timber weir, concrete apron	290	9	[3] 114	400	[2] 1911
	Montrose and Delta	do	Concrete crest, concrete apron	563	12	[3] 68	500	[2] 1915
	Selig	do	Pile and timber weir, removable crest and concrete apron.	300	10	96	500	[2] 1914

Idaho:								
Lewiston Orchards	Sweetwater	Sweetwater Creek	Rockfill weir, concrete crest wall	77	8	80	7,500	1948
	Webb Creek	Webb Creek	do	20	10	75	1,300	1948
Idaho-Oregon:								
Boise	Black Canyon [4]	Payette	Concrete gravity, ogee overflow section.	1,360	111	1,039	81,204	1924
	Boise River	Boise	Concrete and masonry weir, removable crest.	2,815	39	500	26,100	1908
Idaho-Wyoming:								
Minidoka	Cascade Creek	Cascade Creek	Rockfilled log crib weir	220	6	217	3,068	1937
	Cross Cut	Snake, Henrys Fork	Concrete gravity weir, ogee overflow.	591	10	457	7,375	1938
Kansas:								
Webster unit (Missouri River Basin).	Woodston	Solomon, South Fork	Concrete overflow, embankment wing.	160	14	2,290		(1)
Kansas-Nebraska:								
Bostwick Division (Missouri River Basin).	Superior-Courtland	Republican	Concrete ogee weir, embankment wings.	890	8	4,000	179,000	1950
Montana:								
Bitter Root	Rock Creek	Rock Creek	Timber sheet piling, concrete weir cap.	330	5	80	560	1950
Frenchtown	Frenchtown	Offstream	Earth and rock	172	13	489	12,176	1936
Huntley	Yellowstone River	Yellowstone	Concrete weir	400	8	250	1,674	1934
Milk River	Dodson	Milk	Timber-crib weir, movable crest, embankment wings.	700	23	8,154	87,355	1910
	Saint Mary	Saint Mary	Concrete weir	850	6	198	1,230	1915
	Swift Current	Swift Current Creek	Earth and rock, timber-crib core		13	4,800	98,400	1915
	Vandalia	Milk	Reinforced concrete slab-and-buttress weir, movable crest, embankment wing.	300	27	2,350	15,207	1917
Sun River	Sun River	Sun, North Fork	Concrete arch, overflow	1,400	114	261	6,466	1915
Montana-North Dakota:								
Lower Yellowstone	Lower Yellowstone	Yellowstone	Rockfilled timber-crib weir, embankment wing.	840	4	700	22,500	1910
Nebraska:								
Frenchman-Cambridge Division (Missouri River Basin).	Bartley	Republican	Concrete weir, embankment wings	130	3	3,100	60,000	1954
	Cambridge	do	Concrete weir, embankment wing	325	2	4,650	18,500	1949
Mirage Flats	Dunlap	Niobrara	Concrete weir, embankment wing, overflow.	220	6	577	6,356	1945
Sargent unit (Missouri River Basin).	Milburn	Middle Loup	Concrete gate structure, embankment wings.	260	12	3,880	70,000	1956
Nebraska-Wyoming:								
North Platte	Dry Spotted Tail Creek	Dry Spotted Tail Creek	Steel sheet pile and earth		13	255	650	1954
	Horse Creek	Horse Creek	Concrete weir, embankment wing	430	6	720	5,260	1923
	Tub Springs Creek	Tub Springs Creek	Steel sheet pile and earth		9	205		1954
	Whalen	North Platte	Concrete weir, embankment wing	3,700	11	2,460	81,700	1909
Nevada-California:								
Newlands	Carson River	Carson	Concrete gate structure	1,950	14	241	2,707	1905
	Derby	Truckee	Concrete gate structure, embankment wing.	1,500	15	1,331	36,572	1905

See footnotes at end of table.

TABLE 13.—*Bureau of Reclamation diversion dams, June 30, 1957*—Continued

State and project	Name of dam	River	Type	Capacity (acre-feet)	Height (feet)	Length (feet)	Volume (cubic yards)	Year
New Mexico:								
Fort Sumner	Fort Sumner	Pecos	Concrete gravity weir, overflow	100	11	715	27, 258	1951
Middle Rio Grande	Angostura	Rio Grande	Concrete, wall weir		5	800	1, 538	(5)
	Isleta	do	Concrete, gate structure	1, 051	5	674	3, 874	[2] 1955
	San Acacia	do	do	265	8	700	2, 710	[2] 1956
Vermejo	Vermejo	Vermejo	Concrete weir, overflow, embankment wing.	600	5	1, 021	4, 428	[2] 1955
New Mexico-Texas:								
Rio Grande	Leasburg	Rio Grande	Concrete weir, embankment wings	700	7	2, 865	22, 500	1907
	Mesilla	do	do	965	10	303	23, 600	1916
	Percha	do	do	350	12	2, 720	43, 238	1917
	Percha Arroyo	Percha Arroyo	Earth, rock-faced	30, 000	19	2, 489	192, 884	1939
	Riverside	Rio Grande	Concrete weir, embankment wings	1, 000	6	283	145, 150	1928
Oregon:								
Deschutes	North Canal	Deschutes	Concrete arch-gravity, overflow	1, 000	28	293	4, 900	(5)
Grants Pass	Savage Rapids	Rogue	Concrete gravity and multiple arch	207	30	456	5, 600	[2] 1955
Umatilla	Feed Canal	Umatilla	Concrete, rock, and timber weir, embankment wing.	350	4	2, 100	14, 110	1907
	Maxwell	do	Concrete and timber-crib weir, embankment wing.	140	4	400	464	1912
	Three Mile Falls	do	Concrete multiple arch	300	23	915	5, 068	1914
Vale	Harper	Malheur	Concrete gate structure, embankment wing.	662	12	914	9, 258	1929
Oregon-California:								
Klamath	Lost River	Lost	Concrete multiple arch, overflow, embankment wings.	3, 000	26	675	19, 915	1912
	Lower Lost River	do	Reinforced concrete slab-and-buttress.	810	12	324	689	1921
	Malone	do	Concrete gate structure, embankment wing.	220	18	515	21, 200	1923
	Miller	Miller Creek	Concrete weir, removable crest, embankment wing.	190	5	290	1. 615	1924
South Dakota:								
Belle Fourche	Belle Fourche	Belle Fourche	Concrete weir, embankment wings	1, 635	18	2, 523	35, 700	1907
Texas:								
Balmorhea	Madera	Madera Creek	Concrete weir	125		950		[2] 1947
Utah:								
Moon Lake	Duchesne Feeder Canal	Duchesne	Concrete weir, embankment wings	200	6	[3] 220	4, 000	1939
Provo River	Broadhead	Broadhead Creek	Concrete overflow weir, embankment wing.	22	4	68	708	1953
	Duchesne	Duchesne, North Fork	Rockfill weir, concrete core wall	600	17	480	10, 020	1952
	Murdock	Provo	Concrete weir, overflow, embankment wing.	550	19	370	9, 036	1950

	Weber River	Weber	Concrete ogee, overflow weir, embankment wings.	1,000	19	1,795	15,400	1930
Strawberry Valley	Indian Creek Crossing	Indian Creek	Earth	750	5	1,350	15,200	1913
	Spanish Fork	Spanish Fork	Concrete weir, ogee section	500	13	74	1,020	1908
Weber Basin	Slaterville	Weber	Concrete	1,660	8	162	1,900	1957
	Stoddard	do	do	700	8	110	1,900	1956
Washington:								
Okanogan	North Fork Salmon Creek.	Salmon Creek, North Fork.	Concrete, embankment wings			50		1920
	Salmon Creek	Salmon Creek	Concrete ogee weir, embankment wing.	100	5	140	800	1906
Yakima	Easton [4]	Yakima	Concrete gravity, overflow, movable crest.	1,200	43	248	5,760	1929
	Prosser	do	Concrete gravity weir	1,500	7	[3] 661	2,466	[2] 1956
	Roza	do	Concrete weir, movable crest	2,200	34	486	21,711	1939
	Sunnyside	do	Concrete weir, embankment wing	1,320	6	[3] 500	1,809	1907
	Tieton	Tieton	do	320	3	510	1,368	1908
Wyoming:								
Riverton	Wind River	Wind River	do	2,200	19	2,464	123,860	1923
Wyoming-Montana:								
Shoshone	Corbett	Shoshone	Concrete slab-and-buttress weir, embankment wing.	1,000	12	938	10,190	1908
	Willwood	do	Concrete gravity, overflow, embankment wing.	320	41	476	22,119	1924

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[1] Under construction.

[2] Non-Reclamation construction. Date is of supplemental construction by Bureau of Reclamation.

[3] Weir length only.

[4] Diversion and storage.

[5] Non-Reclamation construction. Supplemental construction by Bureau of Reclamation.

DEFINITIONS

Capacity: Amount of diversion provided by canal headworks at dam.

Height: Distance between original streambed and highest controlled water surface.

Length: Extent of barrier in dam and integral features constructed between natural abutments, except as indicated in footnote 3.

Volume: Space occupied by all material in dam and its appurtenant features.

Year: Date original construction was completed by Bureau of Reclamation, except as indicated in footnotes 2 and 5.

TABLE 14.—*Annual appropriations and allotments from reclamation and other funds, fiscal years 1903–57*

Fiscal year	Annual acts			Emergency relief funds allocated	Fort Peck continuing fund	Permanent appropriations	Total [1]
	Reclamation fund	General fund	Colorado River dam fund				
1903	$6, 115, 000						$6, 115, 000
1904	16, 890, 000						16, 890, 000
1905	4, 750, 000						4, 750, 000
1906	12, 015, 161						12, 015, 161
1907	2, 209, 000						2, 209, 000
1907 [2]	[1] 41, 979, 161						[1] 41, 979, 161
1907	34, 313, 233						34, 313, 233
1908	7, 918, 366	$105					7, 918, 471
1909	9, 791, 400						9, 791, 400
1910	9, 368, 000						9, 368, 000
1911	27, 366, 790						27, 366, 790
1912	6, 459, 000	391					6, 459, 391
1913	6, 271, 000						6, 271, 000
1914	14, 759, 574						14, 759, 574
1915	6, 746, 634						6, 746, 634
1916	13, 530, 000						13, 530, 000
1917	8, 887, 557	15, 000					8, 902, 557
1918	8, 227, 000	331, 423					8, 558, 423
1919	9, 397, 000	453, 437					9, 850, 437
1920	7, 300, 000	560, 074					7, 860, 074
1921	8, 463, 000	672, 177					9, 135, 177
1922	20, 266, 000	346 871					20, 612, 871
1923	14, 800, 000	570, 530					15, 370, 530
1924	13, 800, 000	334, 867					14, 134, 867
1925	11, 890, 809						11, 890, 809
1926	12, 575, 774	687 336					13, 263, 110
1927	7, 436, 320	75, 000					7, 511, 320
1928	12, 148, 800	122, 640					12, 271, 440
1929	14, 328, 400	115, 000					14, 443, 400
1930	8, 643, 000	10, 760, 000					19, 403, 000
1931	9, 482, 000	100, 000					9, 582, 000
1932	7, 271, 000	15, 100, 000					22, 371, 000
1933	2, 817, 288	23, 050, 513					25, 867, 801
1934	3, 408, 000	8, 048, 000		$103, 535, 000			114, 991, 000
1935	1, 176, 750			34, 076, 000			35, 252, 750
1936	1, 388, 100	15, 950, 000		25, 438, 000			42, 776, 100
1937	12, 344, 600	34, 850, 000	$350, 000	[1] 4, 873, 000			42, 671, 600
1938	12, 322, 600	30, 570, 000	500, 000	37, 047, 500		$1, 100, 000	81, 540, 100
1939	10, 940, 600	32, 995, 000	500, 000	[1] 2, 502, 488		4, 600, 000	46, 533, 112
1940	13, 875, 600	64, 215, 000	575, 000	28, 347		5, 700, 000	84, 393, 947
1941	10, 000, 600	62, 971, 335	768, 000	[1] 124, 300		6, 600, 000	80, 215, 635
1942	8, 111, 000	92, 862, 031	1, 000, 000	[1] 19, 961		2, 600, 000	104, 553, 070
1943	3, 607, 960	86, 645, 460	1, 379, 250	[1] 1, 131		2, 600, 000	94, 231, 539
1944	4, 514, 475	35, 702, 067	1, 443, 100	[1] 72, 709	$300, 000	5 600, 000	47. 486, 933
1945	7, 649, 800	18, 601, 448	2, 200, 000	[1] 22, 332	100, 000	13, 100, 000	41, 628, 916
1946	36, 617, 890	83, 701, 182	2, 550, 000		200, 000	4, 856, 302	127, 925, 374
1947	39, 600, 213	75, 901, 805	1, 814, 330	[1] 30, 396		4, 600, 000	121, 885, 952
1948	25, 676, 750	115, 478, 461	2, 088, 000		308, 000	5. 280, 000	148, 831, 211
1949	36, 952, 264	227, 636, 453	2, 450, 000		355, 000	4, 440, 000	271, 833, 717
1950	44, 759, 817	312. 269, 827	2, 123, 100		403, 229	7, 641, 440	367, 197, 413
1951	46, 917, 165	222, 453, 635	2, 308, 000		358, 605	5, 694, 729	277, 732, 134
1952	51, 422, 347	180, 665, 175	2, 171, 000		634, 900	6, 665, 088	241, 558, 510
1953	72, 945, 450	130, 859, 541	2, 643, 000		695, 796	7, 743, 965	214, 887, 752
1954	74, 884, 496	65, 505, 454	2, 679, 710		633, 802	4, 610, 748	148, 314, 210
1955	83, 553, 419	75, 444, 114	2, 442, 778		735, 900	5, 953, 500	168, 129, 711
1956	98, 139, 950	79, 733, 362	2, 281, 688		716, 626	4, 403, 500	185, 275, 126
1957	94, 050, 700	97, 798, 800	2, 615, 000		741, 712	5, 711, 617	200, 917, 829
Total	1, 109, 118, 491	2, 204, 153, 514	36, 881, 956	192, 478, 530	6, 183, 570	[3] 109, 500, 889	3, 658, 316, 950

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[1] Credit.

[2] Allotments made prior to Fallon, Nevada Conference on July 27, 1907, were canceled and summary allotments issued.

[3] Repayment of advances included: Boulder Canyon $23,505,058, and All-American Canal System, $3,252,000.

TABLE 15.—*The reclamation fund, fiscal years 1956–58, funds available for appropriation*

Receipts and appropriations	Actual 1956	Actual 1957	Estimated 1958
Unappropriated balance brought forward (as of June 30)	$92,751,703	$87,217,904	$98,960,399
Accretions and collections:			
Bureau of Reclamation and other agencies, .100	11,970,724	14,720,566	15,387,100
Other agencies, .200	35,583,729	39,615,072	46,198,300
Power revenues, .300	43,736,392	46,552,469	45,529,500
Subtotal, accretions and collections	91,290,845	100,888,107	107,114,900
Plus expired and lapsed appropriations	1,318,806	5,038,417	
Total available for appropriation	185,361,354	193,144,428	206,075,299
Less permanently authorized appropriations for:			
Refund of revenue collections		125,000	125,000
Farmers Irrigation District, North Platte project, Nebraska	3,500	8,329	8,000
Deduct annual appropriation or estimate for:			
General investigations	4,421,812	4,970,000	5,182,000
Construction and rehabilitation	69,287,000	63,083,000	55,000,000
Operation and maintenance	20,171,138	22,055,700	22,740,000
General administrative expenses	[2] 3,760,000	3,942,000	4,164,000
Emergency fund	500,000		
Total annual appropriation or estimate	98,139,950	94,050,700	87,086,000
Total appropriations	98,143,450	94,184,029	87,219,000
Balance carried forward	87,217,904	98,960,399	118,856,299

TABLE 16.—*Accretions to reclamation fund by States, fiscal year 1957*

State	Sale of public land		Proceeds from oil leasing act		Total to June 30, 1957
	Fiscal year 1957	To June 30, 1957	Fiscal year 1957	To June 30, 1957	
Alabama			$2,849.43	$212,110.01	$212,110.01
Arizona	$196,287.57	$3,357,244.39	49,813.80	428,158.54	3,785,402.93
Arkansas			5,827.76	37,641.62	37,641.62
California	870,652.73	11,671,834.13	4,346,103.58	69,921,136.12	81,592,970.25
Colorado	246,317.37	11,477,985.51	5,959,944.75	35,596,999.34	47,074,984.85
Florida			419.08	2,589.04	2,589.04
Idaho	249,581.39	8,473,264.17	206,061.15	931,298.75	9,404,562.92
Illinois				74.81	74.81
Kansas		1,046,296.83	56,534.64	471,601.33	1,517,898.16
Louisiana			125,212.99	848,501.12	848,501.12
Michigan			1,816.22	29,726.87	29,726.87
Mississippi			4,297.41	21,055.02	21,055.02
Montana	182,763.66	16,473,418.32	1,630,958.74	12,718,915.99	29,192,334.31
Nebraska	2,710.95	2,216,018.17	12,619.64	72,134.62	2,288,152.79
Nevada	638,275.50	2,101,981.24	443,609.17	3,425,173.82	5,527,155.06
New Mexico	105,237.65	7,395,023.54	5,599,816.70	41,540,853.58	48,935,877.12
North Dakota	1,985.41	12,287,238.05	98,140.31	906,847.89	13,194,085.94
Oklahoma	1,536.00	5,970,928.02	30,135.56	257,536.71	6,228,464.73
Oregon	925,335.17	16,221,604.50	49,117.18	285,465.98	16,507,070.48
South Dakota	23,643.13	7,864,639.08	101,805.63	722,621.29	8,587,260.37
Utah	118,934.03	5,012,394.59	2,205,632.09	13,907,548.86	18,919,943.45
Washington	370,789.65	9,107,047.88	4,557.65	77,450.33	9,184,498.21
Wyoming	78,206.02	9,543,696.34	13,100,815.30	127,940,275.35	137,483,971.69
Total	4,012,256.23	130,220,614.76	34,036,088.78	310,355,716.99	440,576,331.75

Other accretions	Fiscal year 1957	Totals to June 30, 1957
Proceeds, Federal water power licenses	$58,643.68	$1,517,237.07
Proceeds, potassium royalties and rentals	1,507,586.07	12,447,078.19
Receipts from naval petroleum reserves, 1920–38, act of May 9, 1938		29,778,300.23
Proceeds from rights-of-way over withdrawn lands, act of July 19, 1919	363.96	12,372.00
Miscellaneous items, other		5.78
Miscellaneous mineral leasing permits	113.25	113.25
Total	1,566,706.96	43,755,106.52
Grand total	39,615,051.97	484,331,438.27

TABLE 17.—*Cost of plant, property and equipment in each State, June 30, 1957*

State and project	Completed works				Construction in progress	Other physical property	Total
	Multipurpose (1)	Irrigation (2)	Electric (3)	Municipal (M) and flood (F) (4)	(5)	(6)	(7)
Total	$1, 040, 309, 851	$931, 548, 761	$637, 987, 572	$27, 002, 787	$304, 250, 195	$24, 143, 964	$2, 965, 243, 130
(Alaska): Eklutna			32, 338, 492		96, 131		32, 434, 623
Arizona, subtotal	90, 361, 850	59, 978, 043	108, 463, 647	(F) 3, 454, 942	9, 109, 459	242, 951	271, 610, 892
Boulder Canyon:							
All-American Canal System (California)	2, 179, 950						2, 179, 950
Hoover Dam and powerplant (Nevada)	44, 486, 803		33, 557, 349		57, 710		78, 101, 862
Colorado River Front Work and Levee system (California-Nevada)				(F) 3, 454, 942	85, 632		3, 540, 574
Colorado River Storage: Glen Canyon Unit (Utah)					7, 196, 535		7, 196, 535
Gila		44, 578, 013			946, 688	242, 951	45, 767, 652
Palo Verde (California)					579, 694		579, 694
Parker-Davis (California-Nevada)	38, 615, 885		70, 517, 958		243, 200		109, 377, 043
Salt River	5, 079, 212	10, 731, 853	4, 266, 443				20, 077, 508
Yuma (California)		3, 525, 360	121, 897				3, 647, 257
Yuma Auxiliary		1, 142, 817					1, 142, 817
California, subtotal	304, 464, 678	196, 592, 582	125, 277, 647	(F) 9, 131, 647	82, 577, 465		718, 044, 019
Boulder Canyon: All-American Canal System (Arizona)	38, 659, 291	16, 503, 981		(F) 3, 329, 787	65, 403		58, 558, 462
Cachuma	28, 467, 691				14, 679, 433		43, 147, 124
Central Valley	232, 300, 099	168, 217, 570	106, 045, 350		24, 451, 695		531, 014, 714
Colorado River Front Work and Levee System (Arizona-Nevada)				(F) 5, 801, 860	162, 497		5, 964, 357
Klamath (Oregon)		6, 109, 741			94, 843		6, 204, 584
Orland		2, 583, 870			59, 291		2, 643, 161
Palo Verde (Arizona)					2, 827, 691		2, 827, 691
Parker-Davis (Arizona-Nevada)	5, 037, 597		18, 751, 477		12, 703		23, 801, 777
Santa Maria					4, 097, 011		4, 097, 011
Solano					29, 824, 174		29, 824, 174
Loan Program-Distribution Systems					30, 439		30, 439
Truckee Storage (Nevada)							
Ventura River					6, 260, 251		6, 260, 251
Yuma (Arizona)		3, 177, 420	480, 820		12, 034		3, 670. 274

Colorado, subtotal	53, 451, 065	104, 331, 162	42, 315, 039		869, 265	152, 251	201, 118, 782
Collbran					220, 529		220, 529
Colorado-Big Thompson	36, 284, 928	80, 399, 394	41, 387, 246		160, 263		158, 231, 831
Colorado River Storage: Navajo Unit (New Mexico)					265, 912		265, 912
Fruitgrowers Dam		200, 309					200, 309
Grand Valley		5, 781, 101	213, 669		176, 882		6, 171, 652
Mancos		3, 914, 818					3, 914, 818
Missouri River Basin	13, 296, 854		714, 124		44, 083		14, 055, 061
Paonia		1, 599, 704				152, 251	1, 751, 955
Pine River		3, 469, 877					3, 469, 877
San Luis Valley	3, 869, 283				1, 596		3, 870, 879
Uncompahgre		8, 965, 959					8, 965, 959
Idaho, subtotal	43, 751, 832	46, 781, 648	7, 784, 169	(M) 1, 020, 096	62, 719, 868	27, 978	162, 085, 591
Avondale		244, 424					244, 424
Boise (Oregon)	33, 130, 536	25, 924, 169	5, 030, 810		737, 037		64, 822, 552
Dalton Gardens		258, 660					258, 660
King Hill		1, 877, 732					1, 877, 732
Lewiston Orchards	426, 999	1, 037, 302		1, 020, 096			2, 484, 397
Michaud Flats		26, 899			1, 990, 233		2, 017, 132
Minidoka (Wyoming)	8, 675, 493	16, 028, 102	2, 753, 359		3, 380, 857	27, 978	30, 865, 789
Owyhee (Oregon)		902, 000			66, 112		968, 112
Palisades (Wyoming)	1, 518, 804				56, 445, 168		57, 963, 972
Preston Bench							
Rathdrum Prairie:							
Post Falls		363, 951					363, 951
Hayden Lake		118, 409					118, 409
Hayden Lake, Nevada					100, 461		100, 461
Iowa: Missouri River Basin transmission lines			1, 150, 660		1, 411, 558		2, 562, 218
Kansas, subtotal	39, 066, 552	2, 773, 980			16, 260, 977		58, 101, 509
Garden City		334, 475					334, 475
Missouri River Basin	39, 066, 552	2, 439, 505			16, 260, 977		57, 767, 034
Minnesota: Missouri River Basin transmission lines			183, 001		3, 592, 984		3, 775, 985
Montana, subtotal	120, 438, 992	48, 586, 249	45, 086, 899		7, 166, 344	236, 560	221, 515, 044
Bitter Root		1, 052, 873			36, 554		1, 089, 427
Buffalo Rapids		4, 696, 541			228, 427		4, 924, 968
Fort Peck (North Dakota)			10, 573, 151		52, 993		10, 626, 144
Frenchtown		279, 321					279, 321
Hungry Horse	79, 455, 164		22, 140, 294		50, 070		101, 645, 528
Huntley		1, 745, 066			30, 109		1, 775, 175
Intake		94, 213					94, 213
Lower Yellowstone (North Dakota)		3, 031, 353					3, 031, 353
Milk River		9, 343, 132			269, 043		9, 612, 175
Missoula Valley		278, 320					278, 320
Missouri River Basin	39, 422, 077	1, 990, 609	8, 968, 435		6, 125, 908	236, 560	56, 743, 589

TABLE 17.—*Cost of plant, property and equipment in each State, June 30, 1957*—Continued

State and project	Completed works: Multipurpose (1)	Completed works: Irrigation (2)	Completed works: Electric (3)	Completed works: Municipal (M) and flood (F) (4)	Construction in progress (5)	Other physical property (6)	Total (7)
Montana, subtotal—Continued							
Shoshone (Wyoming)	$1, 561, 751	$16, 075, 988	$3, 405, 019		$294, 769		$21, 337, 527
Sun River		9, 998, 833			78, 471		10, 077, 304
Nebraska, subtotal	37, 102. 112	41, 711, 852	7, 625, 980		8, 602, 038		95, 041, 982
Mirage Flats		3, 061, 626					3, 061, 626
Missouri River Basin	37, 102, 112	28. 825, 696	7, 382, 412		8, 602, 038		81, 912, 258
North Platte (Wyoming)		9, 824, 530	243, 568				10, 068, 098
Nevada, subtotal	53, 354, 380	9, 822, 197	36, 717, 607	(F)$102, 123	311, 649	$7, 469, 302	$107, 777, 258
Boulder Canyon:							
Hoover Dam and powerplant (Arizona)	49, 911, 214		32, 122, 062		150, 907	1, 710, 803	83, 894, 986
Boulder City Municipal						5, 723, 273	5, 723, 273
Colorado River front work and levee system (California-Nevada)				(F)102, 123	85, 633		187, 756
Humboldt		1, 214, 321			69, 775		1, 284, 096
Newlands		7, 515, 453	344, 343			35, 226	7, 895, 022
Parker-Davis (Arizona-California)	3, 443, 166		4, 251, 202		5, 334		7, 699, 702
Truckee Storage (California)		1, 092, 423					1, 092, 423
New Mexico, subtotal	16, 420, 004	38, 430, 275	8, 117, 143	(F)272, 926	5, 600, 016		68, 840, 364
Carlsbad	3, 179, 992	2, 059, 600					5, 239, 592
Colorado River Storage:							
Navajo Unit (Colorado)							
Fort Sumner		2, 371, 986					2, 371, 986
Hondo		339, 377					339, 377
Middle Rio Grande	3, 705, 925	11, 096, 629			5, 415, 949		20, 218, 503
Rio Grande (Texas)	8, 135, 637	6, 004, 055	8, 117, 143	(F)272, 926	172. 067		22, 701, 828
Tucumcari		15, 474, 082					15, 474, 082
Vermejo	1, 398, 450	1, 084, 546			12, 000		2, 494, 996
North Dakota, subtotal	8, 327, 991	3, 426, 562	28, 812, 475		1, 427, 040		41, 994, 068
Buford-Trenton		1, 089, 696			565		1, 090, 261
Buford-Trenton, old		223, 423					223, 423
Fort Peck (Montana)			1, 552, 945		655		1, 553, 600

Lower Yellowstone (Montana)		554, 574					554, 574
Missouri River Basin	8, 327, 991	1, 149, 774	27, 259, 530		1, 425, 820		38, 163, 115
Williston		409, 095					409, 095
Oklahoma, subtotal	6, 958, 534	5, 136, 251		(M) 152, 026	713, 845		12, 960, 656
W. C. Austin	6, 958, 534	5, 136, 251		(M) 152, 026			12, 246, 811
Washita Basin					713, 845		713, 845
Oregon, subtotal		48, 651, 074	583, 940		4, 267, 224	13, 332	53, 515, 570
Arnold [1]							
Baker		225, 015					225, 015
Boise (Idaho)		4, 275					4, 275
Burnt River		601, 026					601, 026
Crescent Lake Dam					320, 253		320, 253
Deschutes		11, 596, 561	515, 304		910, 967		13, 022, 832
Grants Pass—Savage Rapids Dam [1]							
Grants Pass—Savage Rapids Fish Facil					22, 533		22, 533
Klamath (California)		8, 139, 064	68, 636		104, 428	13, 332	8, 325, 460
Ochoco [1]							
Owyhee (Idaho)		18, 006, 361			301, 860		18, 308, 221
Rogue River					649, 332		649, 332
Rogue River—Talent Division					1, 951, 339		1, 951, 339
Umatilla		5, 211, 948			6, 512		5, 218, 460
Vale		4, 866, 824					4, 866, 824
South Dakota, subtotal	24, 901, 087	8, 881, 745	35, 384, 810		8, 548, 153	73, 630	77, 789, 425
Belle Fourche		5, 038, 107					5, 038, 107
Missouri River Basin	23, 980, 864	3, 843, 638	35, 384, 810		8, 548, 153	73, 630	71, 831, 095
Rapid Valley	920, 223						920, 223
Texas, subtotal	23, 439, 644	5, 030, 067			23, 015		28, 492, 726
Balmorhea		406, 533					406, 533
Colorado River	23, 439, 644						23, 439, 644
Falcon							
Rio Grande (New Mexico)		4, 623, 534			23, 015		4, 646, 549
Utah, subtotal	16, 372, 794	18, 668, 567	91, 804	(M) 12,869,027	28, 479, 000	61, 085	76, 542, 277
Colorado River Storage:							
Glen Canyon Unit (Arizona)							
Flaming Gorge Unit (Wyoming)					932, 264		932, 264
Hyrum		953, 854					953, 854
Moon Lake		1, 799, 859					1, 799, 859
Newton		712, 592					712, 592
Ogden River		5, 000, 984					5, 000, 984
Provo River	15, 428, 957	3, 710, 321		(M)12,869,027	958, 772		32, 967, 077
Sanpete		433, 940					433, 940

See footnote at end of table

TABLE 17.—*Cost of plant, property and equipment in each State, June 30, 1957*—Continued

State and project	Completed works				Construction in progress	Other physical property	Total
	Multipurpose	Irrigation	Electric	Municipal (M) and flood (F)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Utah, subtotal—Continued							
Scofield	$943,837						$943,837
Strawberry Valley		$3,332,530	$91,804			$61,085	3,485,419
Weber Basin					$26,587,964		26,587,964
Weber River		2,724,487					2,724,487
Washington, subtotal	157,240,699	249,260,855	110,746,102		38,268,371	11,877,791	567,393,818
Chief Joseph Dam					1,134,881		1,134,881
Columbia Basin	151,479,303	205,450,911	107,623,563		28,420,137	11,877,791	504,851,705
Okanogan		1,498,251			7,319		1,505,570
Yakima	5,761,396	42,311,693	3,122,539		8,706,034		59,901,662
Wyoming, subtotal	44,657,637	43,485,652	47,308,157		24,156,442	996,450	160,604,338
Colorado River Storage:							
Flaming Gorge Unit (Utah)							
Eden		4,316,812			2,049,853		6,366,665
Kendrick	5,166,889	9,969,250	15,308,613		34,070		30,478,822
Minidoka (Idaho)		2,209,904					2,209,904
Missouri River Basin	32,750,585	610,751	30,175,899		20,871,808	11,582	84,420,625
North Platte (Nebraska)	3,321,120	9,275,237	1,343,579		176,362		14,116,298
Palisades (Idaho)	448,574				376,396		824,970
Riverton	2,970,469	17,087,298	480,066		647,953	984,868	22,170,654
Shoshone (Montana)		16,400					16,400
Non-project property					49,351	2,992,634	3,041,985

NOTES.—Name of State in which balance of project is located is indicated by parentheses (except Missouri River Basin, located in 10 States). Irrigation plant is listed at gross construction cost prior to deduction of chargeoffs authorized by Congress. Municipal and industrial water plant (M) totals $14,041,149 and flood control plan (F) totals $12,961,638.

[1] Construction costs classified as funded operation and maintenance charges.

The 11th edition of the Bureau's Hydraulic and Excavation Tables comprising computational data for use in design and construction of hydraulic structures was published during the year. Technical records on the design and construction of Anderson Ranch Dam and powerplant, Boysen Dam and powerplant, and volume I of the Colorado-Big Thompson project, covering planning, legislation, and general description of the project were also published. The Materials Laboratory Procedures Manual was issued.

In response to 7,575 requests for the Bureau's publications and informational materials received from individuals in this country and in foreign countries, 21,000 copies of technical publications and informational pamphlets were sold or distributed. Sales of Bureau publications totaled $24,000, more than one-half of this total being made to foreign countries. Sales of publications sold for the Superintendent of Documents totaled $6,200.

PROJECT DEVELOPMENT

The project development program involves preparation of comprehensive plans for development of river basin resources and the investigation and planning of potential projects for the conservation and utilization of the water resources of the West. It also includes detailed preconstruction studies on newly authorized projects.

Comprehensive Basin Surveys

Comprehensive surveys were undertaken in 12 basins throughout the West. Of these studies, an interim evaluation report was prepared on the Umpqua River Basin in Oregon, and a report on the Upper American River basin in California approached completion. In addition, comprehensive studies were active in 14 subbasins of the Missouri River Basin project, with reports completed on the Kansas River Basin, the North Platte River Basin and the Powder Division.

Investigations continued on the permanently authorized investigations program of the Bureau in Alaska.

Project Planning Reports

By the end of the fiscal year, feasibility reports had been submitted to Congress on the San Luis Unit of the Central Valley project in California, the Burns Creek Dam, Reservoir and powerplant of the Palisades project in Idaho, the Mercedes Division of the Lower Rio Grande rehabilitation project in Texas, and on the San Angelo project in Texas.

Reports submitted to the Bureau of the Budget include those on the Greater Wenatchee Division of the Chief Joseph Dam project in Washington and the Norman project in Oklahoma.

Reports being reviewed by States and Federal agencies prior to submission to the Bureau of the Budget include those on the Spokane Valley project in Washington, the Harlingen, El Jardin and La Feria Divisions of the Lower Rio Grande rehabilitation project in Texas, the Rio Grande and Weminuche Pass Divisions of the San Luis Valley project in Colorado, and the Garrison diversion unit of the Missouri River Basin project in North and South Dakota.

The Harlingen Division of the Lower Rio Grande rehabilitation project was subsequently considered by the local interests for construction under the Small Reclamation Projects Act of 1956.

Definite Plans Reports

Definite plans reports were completed and approved on the Webster unit of the Missouri River Basin project in Kansas, the Hayden Lake unit of the Rathdrum Prairie project in Idaho, the Foster Creek Division of the Chief Joseph Dam project in Washington, the Juniper Division of the Wapinitia project in Oregon, Little Wood River project in Idaho, East Bench unit of the Missouri River Basin project in Montana, and the Collbran project in Colorado.

Loan Program

The Small Reclamation Projects Act of 1956 was approved by the President on August 6, 1956. The act contained provisions objectionable to the President which prevented the approval of projects for loans until amendments were made. The necessary amendments were passed by the Congress and were approved by the President on June 5, 1957. This act permits loans of up to $5 million for the development of irrigation projects which may cost up to $10 million. It also permits nonreimbursable grants for certain public benefits, up to $5 million for both the loan and the grant.

Although projects could not be approved until the act was amended, the Bureau worked with various applicants in preparing their material. Two applications were almost ready for Secretarial consideration by the end of the fiscal year and several others were well advanced.

Public Law 130, 83d Congress authorized loans for the construction of irrigation distribution systems on authorized projects in lieu of construction by the Bureau. One loan for $12,302,000 to the Solano Irrigation District in California was approved.

River Compacts

The Bear River Compact, previously ratified by Idaho and Utah, was ratified by the State legislature of Wyoming and submitted to the Congress for approval.

The Klamath River Compact was ratified by the State legislatures of California and Oregon and submitted to the Congress for approval.

The Columbia River Compact, previously approved by the Columbia Interstate Compact Commission and submitted to several State legislatures for approval and ratified by the States of Idaho, Nevada, and Utah was subsequently modified on August 6, 1956, and resubmitted to the State legislatures of Washington, Oregon, Idaho, Montana, Wyoming, Utah, and Nevada for ratification.

Bills were introduced in the Congress requesting consent to negotiate compacts between the ten Missouri River Basin States regarding the Missouri River and between Wyoming, Montana, and North Dakota, regarding the Little Missouri River.

The consent of the Congress to negotiate compacts had been previously obtained for compacts between Arkansas and Oklahoma and between Kansas and Oklahoma regarding the Arkansas River; between Arkansas, Louisiana, Oklahoma and Texas regarding the Red River; between California and Nevada regarding the Truckee, Carson, and Walker Rivers, and Lake Tahoe; and between Wyoming and Nebraska regarding the Niobrara River. Preparation of those compacts are awaiting compilation of necessary hydrologic data which is in progress.

Hydrology

General hydrologic problems which confront investigators on many proposed Reclamation projects were under study this past fiscal year. These studies covered the fields of storm and flood hydrology, sedimentation and water conservation and utilization.

Procedures for the preparation of tailwater curves, which have been under development for the past several years, were formulated in a technical manual.

Investigation of evaporation along several lines has continued in collaboration with the Geological Survey. High altitude studies at Granby Reservoir and Pikes Peak, both in Colorado, were continued to assist in evaluating reservoir evaporation in the higher and more remote areas of the Western States.

Studies were started in cooperation with the Soil Conservation Service and the Agriculture Research Service, to develop methods of procedure for the determination of the effects of watershed treatment measures upon downstream runoff.

International Streams Investigations

The Souris-Red Rivers Engineering Board through interested Federal agencies continued the systematic collection and study of hydrologic data and related flood control, and irrigation investigations in the Souris and Red Rivers. The Board also assisted the Commission on engineering matters in the consideration of an apportionment of the waters of the Souris River between the United States and Canada under the Souris-Red Rivers reference of January 12, 1948. During the fiscal year the Waterton-Belly Rivers Engineering Board was inactive in connection with the Waterton-Belly Rivers reference of the same date.

PROGRAM COORDINATION AND FINANCE

Construction schedules and the estimates supporting these schedules were expanded to include the cost of appurtenant activities which, while not technically construction costs, are necessary in the process of bringing a project to condition for operation and maintenance. This refinement resulted in a more realistic estimate of the total and annual funds required for construction projects.

Coordination of apportionments with contract award schedules was refined so that the amounts established for obligation by quarters more closely parallel requirements of the construction projects.

In finance and accounting operations a number of new procedures in cost accounting and reporting were instituted; a centralized finance organization was established for the Upper Colorado River Storage project; an accountant's trainee program was inaugurated; and a feasibility study of the use of electronic equipment in accounting operations was in process at the end of the fiscal year.

Statistical time series references designated as official source for frequently required administrative and management data on the Bureau's activities were maintained current. These covered (*a*) current and projected program operations presented in the Bureau's Monthly Report on Progress and Status of Funds; Forecasts on Utilization of Funds, Bureau Progress, Monthly Federal Civilian and other interim and annual employment reports; (*b*) operating financial and related physical data presented in the Bureau's Statistical Appendix to the Secretary's Annual Report; and (*c*) pertinent interim reports and chart exhibits. In addition, manuscripts were prepared for new editions of the Bureau's publications titled "Project Feasibilities and Authorizations"; "Appropriation Acts and Allotments" (new supplement) and "Repayment Histories and Payout Schedules" each of which are regularly brought up-to-date every 5 years, the last editions being those of 1952.

Budget

Appropriations for all purposes made available to the Bureau of Reclamation for fiscal year 1957 totaled $193,864,500. This amount included $12,750,000 in supplemental funds appropriated primarily for loans to irrigation districts for the construction of distribution systems on Bureau projects. Permanent appropriations or revolving funds are not included in this amount. The appropriation for 1957 totaled $13,709,500 more than was appropriated for 1956.

With an unobligated balance of $31.9 million carried over from fiscal year 1956 for construction and investigations, plus one-year appropriations for O. & M. and G. A. E. funds advanced by water users, trust funds and a continuing fund for emergency expenses, Fort Peck project, the total amount available to Reclamation was $231.5 million. Of this amount there remained unobligated at the close of 1957 construction and investigation funds in the amount of $31.9 million which are available for fiscal year 1958.

Obligations for 1957 totaled $197.0 million or 92 percent of the obligations programed as compared to 83 percent of the program accomplished in 1956.

The appropriation act for 1957, as in recent years, prohibited initiating construction on transmission facilities in areas covered by power wheeling contracts unless the wheeling agencies were unable or unwilling to provide the service. Also the limitation upon the amount of money that may be expended for work by Government forces (force account work) was repeated in the 1957 act. This limitation provided that not to exceed 12 percent of the allotment for any one project or unit of the Missouri River Basin project, with a maximum of $225,000 for any such project or unit, was to be so used.

The amounts appropriated by activity for fiscal year 1957, together with the amounts to be derived from the special and general funds, follow:

TABLE 18.—*Condensed statement of appropriations, fiscal year 1957, exclusive of trust funds and permanent appropriations*

General investigations		$5, 680, 000
Reclamation fund	$4, 970, 000	
Colorado River development fund	500, 000	
General fund	210, 000	
Construction and rehabilitation		143, 975, 500
Reclamation fund	$63, 083, 000	
General fund	80, 892, 500	
Upper Colorado River Basin		13, 000, 000
General fund	$13, 000, 000	
Operation and maintenance		27, 267, 000
Reclamation fund	$22, 055, 700	
Colorado River Dam fund	2, 115, 000	
General fund	3, 096, 300	
General administrative expenses		3, 942, 000
Reclamation fund	$3, 942, 000	
Grand total		193, 864, 500
Reclamation fund		$94, 050, 700
Colorado Dam fund		2, 115, 000
Colorado River development fund		500, 000
General fund		97, 198, 800

ADMINISTRATION

Contracts and Property Management

Total procurement by purchase orders and supply and service contracts for the 1957 fiscal year approximated $21,660,000, an increase in dollar value of about $4,280,000, and 25 percent over the preceding fiscal year's business. Orders placed with small-business firms increased about 32 percent from last year, some $2,300,000, or a total in 1957 of $9,122,000. The number of procurement actions increased from 79,513 to 90,962, for the same period, or about 14 percent.

Real property with an acquisition cost of $2,665,066 was disposed of, eliminating cost of management and operation and maintenance of such property.

Personal property with an original cost of $705,566 was declared surplus. Of this amount, $508,700 worth was ultimately sold with proceeds amounting to $147,706 or approximately 29 percent of the original cost. In addition, personal property with an original cost of $146,668 was donated for educational or public health purposes. Personal property acquired from other agencies included property with an original cost of $217,889, for which reimbursement of $87,892 was required. Property with an original cost of $374,694, for which reimbursement was not required, was acquired.

Organization and Methods

New operating guides and procedures were prepared and issued through the Reclamation instruction system to cover the development of cost estimates for construction and irrigation, the preparation of the annual crop census report on irrigation projects, the operation and maintenance of irrigation systems, the custody, maintenance, and disposition of Bureau property other than real estate, and administrative subjects of general interest.

General Services

The incentive awards activity increased by about 20 percent, a total of 1,103 suggestions for the improvement of Bureau activities and procedures being received during the year. Of these, approximately 49 percent were adopted and the employees who proposed the improvements were awarded $20,685. These suggestions resulted in an estimated gross annual saving of $1,202,965. Over 200 employees were granted cash awards in recognition of superior performance. A Bureau employee participated in a $12,000 award which was the highest cash award that had been granted in a civilian Federal agency.

During the fiscal year the Bureau received and created 11,640 cubic feet of records; disposed of 9,026 cubic feet; transferred to Federal records centers for custody and servicing 1,704 cubic feet; and, transferred to other Government agencies, water users' organizations, etc., 531 cubic feet. These resulted in an increase in volume of records held by all Bureau offices from 112,000 to 112,300 cubic feet. This increase was caused primarily by personnel turnovers in a number of field offices which created perceptible slowdowns in disposals and transfers pending training of new qualified personnel. Approximate dollar savings in space and equipment costs as a result of destruction and transfers to low-cost space amounts to $95,040.00.

In response to 7,575 requests for the Bureau's publications and information material received from individuals in this country and in foreign countries, more than 21,000 copies of technical publications and informational pamphlets were sold at Denver or distributed from there. Sales of Bureau publications at Denver totaled $24,000, approximately one-half of this total being made to foreign countries. Sales of publications sold by the Bureau as agent for the Superintendent of Documents totaled $6,200.

In response to 543 requests 8,941 copies of Bureau publications were distributed. Of these requests, 109 were of congressional origin for 1,538 publications and 138 were from agencies of the executive branch of the Federal Government for 929 copies.

Two thousand and ninety-six prints were provided for reproduction in Bureau publications, non-Government textbooks and encyclopedias, various agricultural and engineering magazines and newspapers, and to supplement exhibits and lectures. Requests by mail and in person for visual material were also received from congressional offices and from agencies of the executive branch of the Federal Government.

Seven hundred and twenty-six films were distributed to television stations, agricultural and engineering institutions, water users' associations, organizations of farmers, and to conventions in the United States and abroad.

Comptroller

Ninety-two audit assignments were completed during the year. They comprised 84 comprehensive project audits; 2 audits of water users' organizations, performed at their request; 3 special audits; and 3 miscellaneous assignments which resulted in informal letter reports.

At the request of The Alaska Railroad a member of the Comptroller's staff was temporarily assigned to that agency to assist in the solution of certain technical problems.

Personnel

In order to overcome manpower shortages, increased attention was given to ways in which the skills and abilities of employees could be more effectively utilized. A qualifications data roster was established facilitating the matching of employees' skills and position vacancies on a Bureauwide basis covering all employees in grades GS–9 through GS–14.

A program for the advance scheduling and placement of surplus employees was initiated. Placements for employees on projects nearing completion are scheduled as much as six months in advance; this provides employees with an optimum degree of employment stability.

Aggressive recruitment action was taken to meet continuing manpower shortages in engineering and other categories. Recruitment for engineers was made on a nationwide basis with visits to 114 accredited engineering colleges and universities. More than 150 engineering students and 125 new graduate engineers were brought into Bureau training programs during the year.

Programs for the recruitment and training of beginning accountants and administrative employees were developed and implemented to provide a modest but continuing intake of employees in these categories in support of the engineering organization. There was continued emphasis on other employee development activities.

Extensive position classification review was performed throughout the Bureau and duty realignments accomplished to conform positions to program and organization changes. Bureau personnel technicians participated in Interdepartmental Classification and Wage Conferences held in Denver, Portland, and Washington.

Wage board hearings and negotiations were conducted to adjust pay rates to conform to prevailing practices. Annual negotiations also were held with unions and trades councils in areas under collective bargaining.

Bureau employment increased to 10,506 full-time employees at the end of the 1957 fiscal year from 10,018 at end of 1956.

DIVISION OF FOREIGN ACTIVITIES

Many requests were received from various public and private agencies for assistance to foreign governments in the development of their water resources. However, due to the increased demands of our domestic program and the acute shortage of experienced engineers, Bureau of Reclamation participation in these various technical assistance programs was largely limited to the training of foreign nationals and the performance of specialized laboratory studies and design work in the office of the Assistant Commissioner and Chief Engineer in Denver.

During the year, 141 foreign engineers and other technical people from 21 countries spent periods of 6 months or longer in on-the-job training assignments with the Bureau of Reclamation, and 125 participants from 22 countries spent shorter periods of official observation with our various offices. In addition, there were over 100 foreign accredited visitors and several hundred tourists, students and other foreign nationals who stopped at various Bureau of Reclamation installations.

Under Special Project Agreements with International Cooperative Administration, whereby the Bureau of Reclamation assumes the technical responsibility for certain projects, there were 15 people on overseas assignments during the year in Lebanon, Formosa, and Pakistan. In addition there were 7 Reclamation engineers on extended details to ICA and 3 on short term details. Five Bureau people were on extended assignments to Australia under a Public Law 402 agreement.

The services of the design offices and laboratories in Denver were much in demand. Work was accomplished on the Snowy Mountains Hydro-Electric project, Australia; Wu-Sheh and Shimen Dams, Taiwan; Chao Phya and Yan Hee projects, Thailand; several river basins in Lebanon; and various projects of the Central Water and

Power Commission, India. This work included design, design review, laboratory studies, and the review of reports.

LEGAL

The fiscal year 1957 which included the last 6 weeks of the 84th Congress and the first 6 months of the 85th, was a productive one legislatively.

The three outstanding long-range enactments of the period were Public Law 984, 84th Congress, which, with the amendment embodied in Public Law 47, 85th Congress, sets the groundwork for the program of loans and grants for small reclamation projects toward which Western delegations have been working for many years; Public Law 643, 84th Congress, which should serve to remove objections to the so-called 9 (e) or utility-type contract which is widely used on the Central Valley and Missouri River Basin projects; and Public Law 690, 84th Congress, which clarifies the answers to problems arising out of the acquisition of excess lands by descent, devise, foreclosure, or other process of law.

In addition to these, other principal achievements during the fiscal year were enactment of bills providing authority to construct the Washoe, Crooked River, and Little Wood River projects (Public Law 858, Public Law 992, and Public Law 993, 84th Cong., respectively); reauthorizing the Farwell unit of the Missouri River Basin project (Public Law 952, 84th Cong.); providing for execution of a repayment contract with the Tule Lake Irrigation District, Klamath project (Public Law 877, 84th Cong.); transferring administration of the San Diego aqueduct from the Navy Department to the Interior Department (Public Law 38, 85th Cong.); and providing authority for Government purchase of equipment to be turned over to water users' organizations when they take over the care, operation, and maintenance of projects (Public Law 924, 84th Cong.).

Litigation

Major litigation problems involving water and power problems during the year were:

1. *Rank* v. *Krug*, *et al.*—The history of this case appears in the 1956 Annual Report of the Secretary, page 62. An amended and corrected judgment was filed June 21, 1957.

2. *In the matter of the California Oregon Power Co.* (FPC Project No. 2082; FPC Docket E–6390). A history of these proceedings appear in the 1956 Annual Report of the Secretary, pages 62–63. In an opinion dated October 25, 1956, the United States Court of

Appeals for the District of Columbia dismissed, for lack of a justiciable controversy, the petitions for review by COPCO of the orders of the Federal Power Commission insofar as they are based on findings that COPCO's existing projects and its proposed Big Bend No. 2 project would utilize surplus water from the Link River Dam on the Klamath project.

3. *Citizens Utilities Co.* v. *United States* and *California-Pacific Utilities Co.* v. *United States*, United States Court of Claims (Nos. 364–55, 381–55). The first named action was filed in the Court of Claims September 30, 1955, for damages totaling $12,216,775 alleged to have been sustained as a result of the wrongful and unlawful failure and refusal of the United States to renew its contract for purchase of a portion of the Metropolitan Water District's unused Hoover Dam energy.

On October 12, 1955, California-Pacific Utilities Co., holder of a similar energy contract which also by express terms of limitation terminated December 31, 1954, also filed suit for damages totaling $4,579,807 alleged to have been sustained by reason of the wrongful and unlawful failure and refusal of the United States to renew its said contract. Defendant filed answer in each case, and its motion that the two cases be consolidated was granted by the court on December 29, 1955. Thereupon defendant filed its motion for leave to file motion for notice to third parties, namely, the city of Los Angeles and its Department of Water and Power, Southern California Edison Co., California Electric Power Co. and the Metropolitan Water District of Southern California.

Defendant's motions were granted and the notices to said parties were issued by the clerk of the court on February 1, 1956. Plaintiffs filed motions for summary judgment and briefs in support thereof and a similar motion and brief were filed by defendant. On March 5, 1957, the Court of Claims rendered a unanimous opinion in favor of the plaintiffs. Requests for rehearing were denied on June 5, 1957.

4. *State of Arizona, Plaintiff* v. *State of California et al.*, No. 10, Original, Supreme Court of the United States. In this action the State of Arizona is seeking a determination of its rights in and to he use of the waters of the Colorado River, as against such rights claimed by the defendants, under the Colorado River Compact, the Boulder Canyon Project Act, and the California Limitation Act. Trial of the case before Special Master Simon H. Rifkind continued at intervals throughout the year. Three sessions were held in June 1956; in February 1957; and in May 1957.

5. *Ronald Miller et al.* v. *Robert W. Jennings, et al.*, United States Court of Appeals for the 5th Circuit (No. 16135). This action was brought in the District Court of Hudspeth County, Texas, by Hud-

speth County Conservation and Reclamation District No. 1 and five individual water users claiming to represent a class. The action was removed to the United States District Court for the Western District of Texas.

Plaintiffs sought declaratory and injunctive relief against the Regional Director of the Bureau of Reclamation and others, claiming rights to certain water in the upper Rio Grande which were asserted to have been violated or to be endangered by conduct of the defendants. The court below dismissed the complaint on the ground that the United States had not consented to be sued. This suit was basically a second attempt to obtain relief previously sought in the case of *Hudspeth County Conservation and Reclamation District No. 1* v. *Robbins* (5 Cir. 1954, 213 Fed. 2d 425) which was directed by the Circuit Court to be dismissed for want of jurisdiction against the United States.

In the instant case, the United States was a named defendant and the assertion was made that the United States had waived immunity in the act of July 10, 1952 (66 Stat. 560; 43 U. S. C. sec. 666), concerning the adjudication and administration of rights to the use of water of a river system or other source. The court held that the section was not applicable as no adjudication of rights with respect to the upper Rio Grande could be made where all persons having rights were not before the court. For the requirement that all such persons must be represented the court cited *People of the State of California* v. *United States*, 9th Circuit 1956, 235 Fed. 2d 647; *Wilson* v. *Reeves County Water Improvement District No. 1*, Tex. Civ. App., 256 S. W. 346; and *Martinez* v. *Maverick County Water Control and Improvement District No. 1*, 5th Circuit 1955, 219 Fed. 2d 666.

6. *Arthur E. Graham, also known as Bud E. Graham* v. *United States.* In this action in the United States District Court, District of Arizona, plaintiff seeks to recover $35,100 damages to his property located downstream from Parker Dam, alleged to have resulted from defendant's negligence in connection with dredging operations on the Colorado River conducted by the Bureau of Reclamation. The action is a sequel to a damage claim for like amount filed by Graham's attorneys March 17, 1955, and rejected by the Regional Solicitor, Los Angeles, on June 24, 1955, without consideration of its merits, pursuant to the Federal Tort Claims Act (28 U. S. C., secs. 2401, 2671–2680). On February 19, 1957, plaintiff's attorneys presented a proposal for possible settlement of the action. After discussions with the United States Attorney and the Regional Solicitor, the Regional Director on April 11 rejected the offer.

7. *George H. Pashley, et ux.* v. *United States.* The action was filed in the Court of Claims in March of 1955 for $200,000 in damages for

the alleged flooding of a sodium sulphate deposit below the O'Sullivan Dam as a result of the construction and operation of that dam by the Bureau of Reclamation on the Columbia Basin project. On December 5, 1956, the Commissioner filed a report stating that, in the event the court finds that the plaintiffs are entitled to recover, recovery should not exceed $2,500.

8. *United States* v. *C. F. Williamson et al.; United States* v. *Sylvester E. Flanagan, et al.; United States* v. *Harold Schwab; United States* v. *Western Cold Storage, Inc., et al.; United States* v. *Stephen E. Chaffee, et al.;* and *United States* v. *Clayton W. Michel, et al.* These cases were filed in the United States District Court, Eastern District of Washington in May 1956, charging the defendants with conspiracy in connection with alleged violations of the Columbia Basin Project Act. The defendants in the first three cases pleaded guilty and were given fines or deferred sentences. The indictment in the fourth case was dismissed. The other two cases are awaiting trial.

9. *Charles Washburn* v. *United States* and *James Washburn* v. *United States.* These cases were filed in the United States District Court, Eastern District of Washington, Northern Division, Spokane, Wash., in November 1956, for $10,000 in damages each for the alleged flooding of an access road through operation of Grand Coulee Dam for flood control purposes, and preventing the plaintiffs from reaching land they owned on an island in the Columbia River and farming the same during 1956. Issues have been joined in both cases, and they are awaiting their turns on the trial calendar.

10. *United States* v. *Basin Homes, Inc., et al.* The case was filed in the United States District Court, Eastern District of Washington, Northern Division, Spokane, Wash., in June 1957, for the purpose of obtaining a mandatory injunction requiring the defendants to remove the houses and other obstructions they had constructed on a Columbia Basin project wasteway. The issues in this case have not yet been joined.

11. *J. G. Shotwell* v. *United States, et al.* The case was filed in the United States District Court, Eastern District of Washington, Northern Division, Spokane, Wash., in July 1953, to restrain the defendants from taking and using aggregate produced from and stockpiled on Government-owned land by the plaintiff and for damages in the sum of $13,950 for conversion of aggregate. The United States filed a counterclaim in the sum of $2,000 for aggregate from its land which had been produced and sold by the plaintiff. The temporary restraining order and some of the defendants were subsequently dismissed.

Contract Litigation

Handling of contract litigation is an important function cooperatively performed by the Bureau of Reclamation and the Solicitor's Office. The defense of such cases in the Court of Claims and in the United States district courts, is the primary responsibility of the Department of Justice. However, the Solicitor's Office and administrative personnel of the Department work closely with Department of Justice attorneys in the defense of such cases. Contract claims exceeding $10,000 can be prosecuted by the claimant only in the United States Court of Claims. Claims involving less than $10,000 can be prosecuted either in the local United States district court or in the Court of Claims at the option of the claimant. The bulk of contract litigation both in number of cases and amount involved is in the Court of Claims.

Significant actions or developments in connection with individual contract cases during fiscal year 1957 are as follows:

1. *A. S. Schulman Electric Co.* Plaintiff claims $72,316.76 based upon alleged delays by Government in making available towers upon which the contractor was to string conductors. A hearing for the taking of testimony was held in Los Angeles, Calif., in June 1956. No report has yet been made by the Hearing Commissioner.

2. *Abbett Electric Corp.* v. *United States.* Claim was in the amount of $53,335.13 for increased costs due to Government delays in furnishing completely erected towers on which the contractor was to string conductors. A hearing for taking of testimony was held in San Francisco in January 1956.

3. *Lym Engineering Co.* v. *United States.* This case arose out of a private relief bill introduced in the Congress to relieve the contractor of losses incurred after August 14, 1945, in performing a Reclamation contract. Pre-August 14, 1945, losses had previously been allowed by the Department under the terms of the War Hardship Claims Act. The case was referred to the Court of Claims for a report to the Congress as to the merits of the claim and the amount, if any, legally or equitably due the claimant. The Commissioner of the Court of Claims filed a report on June 27, 1957, finding that the contractor suffered losses after August 14, 1945, in the amount of $111,080.60. There has been no determination of the standing of the claim as legal or equitable against the Government.

4. *J. D. Armstrong, Inc.* v. *United States.* The petition filed by the contractor requests relief in the amount of $65,413.00 based upon four separate claims involving alleged changes, changed conditions, contract interpretation, and breach of contract. Litigation report has been made to the Department of Justice. An answer has been filed denying liability.

5. *Thomas A. Hellander* v. *United States.* This case was submitted to the Congress as a claim for relief, and was referred to the Court of Claims for a report. Plaintiff, who reserved no claims in his release on contract, claims $66,349.30 based upon allegedly erroneous contract interpretations and for losses and damages allegedly incurred due to deficient specifications, premature use of completed work and other causes. Litigation report has been made to the Department of Justice. An answer has been filed denying liability.

6. *Arthur L. Murphy* v. *United States*, *Court of Claims No. 39–57.* The contractor filed a petition which claims $754,472 for allegedly wrongful termination of contractor's right to proceed. A litigation report has been made to the Department of Justice.

BONNEVILLE POWER ADMINISTRATION

William A. Pearl, *Administrator*

FINANCIAL RESULTS OF OPERATIONS

INSTALLED CAPACITY for the Columbia River power system increased by 551,000 kilowatts during the fiscal year. This increase resulted from the installation and placing in service of six 64,000 kilowatt generating units at the Chief Joseph project; two 70,000 kilowatt units at the McNary project and two 13,500 kilowatt fishway units at the Dalles project. The total installed capacity for the system at the end of fiscal year 1957 was 4,702,000 kilowatts.

Actual revenues for 1957 fell below expected amounts because some industrial customers were required to curtail their loads and because lower than average water conditions resulted in less interruptible power available for sale.

Gross revenues increased $5,407,344 or 8.87 percent over the previous year for a total of $66,399,967. After provisions for all costs of operation, including maintenance charges, interest and depreciation expense and miscellaneous charges, net revenues for the year amounted to $5,965,732. The net revenues for fiscal year 1956 were $5,949,412.

Table I presents a combined statement of revenues and expenses for the system. The data are prepared from commercial cost accounts kept in accordance with the Federal Power Commission's system of accounts prescribed for electric utilities.

Summary of Revenue

Table II summarizes by customer categories the source of revenues by fiscal years to and including 1957. The aluminum industry accounted for 30.16 percent of the revenue dollar for fiscal year 1957, while industries other than aluminum accounted for 12.73 percent making a total of 42.89 percent of the gross revenues for the year provided by industrial customers.

Sales to publicly owned utilities were 33.20 percent of the total and privately owned utilities 21.76 percent. Other operating revenues amounted to 2.15 percent.

Increased sales occurred in all categories except aluminum. Sales to aluminum industries decreased $72,410. Sales to other industries increased $264,462 as compared with the previous year; publicly owned utilities $2,539,600, and privately owned utilities $2,450,633.

Repayment of Federal Investment

The gross Federal investment in the power portion of all the generating projects in operation and in related transmission facilities comprises the total of all funds appropriated and requisitioned for construction and operations, together with indirect items such as WPA expenditures and amounts transferred from other Federal agencies, plus interest at 2½ percent on the unrepaid balance.

TABLE I.—*Columbia River power system—condensed summary of revenues and expenses—operating projects only*

	Fiscal year 1956	Fiscal year 1957	Total to June 30, 1957
Operating revenues	$60, 992, 623	$66, 399, 967	$529, 205, 859
Expenses of operation, maintenance, etc	14, 865, 090	16, 257, 324	139, 593, 091
Provision for depreciation	18, 539, 972	20, 255, 154	121, 602, 831
Interest expense	21, 691, 302	24, 015, 702	161, 718, 043
Miscellaneous deductions, etc	(53, 153)	(93, 945)	1, 580, 555
Total deductions	55, 043, 211	60, 434, 235	424, 494, 520
Accumulated net revenues from operations	5, 949, 412	5, 965, 732	104, 711, 339

TABLE II.—*Revenue by class of customers through fiscal year 1957*

Class of customer	1952 and prior	1953	1954	1955	1956	1957	Total to June 30, 1957	1957 percentage (dollar revenue)
Industry:								
Aluminum	$114,449,047	$13,545,562	$15,944,356	$16,909,588	$20,098,110	$20,025,700	$200,972,363	30. 16
Other [1]	29, 540, 568	4, 715, 747	5, 417, 177	6, 821, 850	8, 186, 874	8, 451, 336	63, 133, 552	12. 73
Publicly owned utilities	51, 942, 782	13, 882, 890	14, 882, 997	17, 601, 135	19, 505, 231	22, 044, 831	139, 859, 866	33. 20
Privately owned utilities	63, 271, 265	6, 239, 276	7, 882, 879	9, 926, 150	11, 999, 475	14, 450, 108	113, 769, 153	21. 76
Other operating revenue	6, 050, 223	791, 734	1, 190, 284	807, 759	1, 202, 933	1, 427, 992	11, 470, 925	2. 15
Total operating revenue	265, 253, 885	39, 175, 209	45, 317, 693	52, 066, 482	60, 992, 623	66, 399, 976	529, 205, 859	100. 00

[1] Includes sales to Federal agencies.

As of June 30, 1957, this investment amounted to $1,815,879,985, as shown in table IV. This includes accumulated interest in the amount of $231,195,777. A summary of the interest accumulation is shown in table III.

With the exception of the amounts transferred to the continuing fund, all receipts from power sales and miscellaneous sources allocated to power are deposited in the Treasury to repay the Federal investment.

As of June 30, 1957, repayments total $512,476,083, leaving an unpaid balance of $1,303,403,902. Of the total repaid, $285,651,379 represents payment of all current expenses since inception of the program. The remaining amount of $226,824,704 is repayment on the capital investment of $1,530,228,606 as shown in table IV.

A summary of plant accounts as of June 30, 1957, is shown in table V.

Based on individual projects the return of power capital investment has been as follows:

TABLE III.—*Columbia River power system—summary of interest on Federal investment as of June 30, 1957*

Interest during construction, to be returned during repayment period as part of the Federal investment:		
Bonneville Power Administration	$6, 649, 979	
Bonneville Dam project	2, 333, 827	
Columbia Basin project	9, 687, 396	
Hungry Horse project	4, 708, 543	
McNary Dam project	19, 771, 439	
Albeni Falls project	1, 029, 564	
Detroit-Big Cliff project	2, 593, 463	
Lookout Point-Dexter project	2, 880, 490	
Chief Joseph project	10, 422, 388	
Chandler project	124, 808	
The Dalles project	9, 275, 837	
Subtotal		$69, 477, 734
Interest charged to operations:		
Bonneville Power Administration	$50, 226, 701	
Bonneville Dam project	20, 845, 492	
Columbia Basin project	56, 865, 775	
Hungry Horse project	9, 126, 544	
McNary Dam project	13, 937, 468	
Albeni Falls project	2, 186, 942	
Detroit-Big Cliff project	3, 633, 986	
Lookout Point-Dexter project	2, 291, 228	
Chief Joseph project	2, 470, 164	
Chandler project	117, 060	
The Dalles project	16, 683	
Subtotal		161, 718, 043
Gross interest accumulation		231, 195, 777

TABLE IV.—*Columbia River power system—summary of Federal investment in operating power projects and repayment as of June 30, 1957*

	Gross investment	Repayments	Net investment
Investment in current expenses:			
Operation, maintenance, etc	$123, 933, 336	$123, 933, 336	
Interest [1]	161, 718, 043	161, 718, 043	
Total current expenses	285, 651, 379	285, 651, 379	
Investment in capital assets:			
Electric plant investment [2]	1, 555, 190, 364		
Unexpended appropriations	24, 961, 758		
Total capital investment	1, 530, 228, 606	226, 824, 704	$1, 303, 403, 902
Total Federal investment	1, 815, 879, 985	512, 476, 083	1, 303, 403, 902

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[1] The Columbia River power system does not receive appropriations for payment of interest, but imputes and includes in its accounts provisions for interest expense and returns receipts to the Treasury in repayment of such expenses.

[2] Includes interest during construction of $69,477,734 which will be repaid to the Treasury as part of capital cost of electric plant.

TABLE V.—*Columbia River power system summary of plant accounts in operating projects as of June 30, 1957*

Project	Total	Allocation	
		Nonpower	Power
Bonneville Power Administration	$419, 386, 054		$419, 386, 054
Bonneville Dam project	86, 703, 455	$27, 194, 875	59, 508, 580
Columbia Basin project	513, 420, 261	308, 591, 021	204, 829, 240
Hungry Horse project	107, 574, 282	20, 667, 974	86, 906, 308
Albeni Falls project	31, 275, 645	286, 788	30, 988, 857
McNary Dam project	303, 978, 954	25, 816, 845	278, 162, 109
Detroit-Big Cliff project	65, 772, 144	24, 153, 158	41, 618, 986
Lookout Point-Dexter project	92, 547, 552	51, 129, 756	41, 417, 796
Chief Joseph project	148, 830, 552	1, 151, 051	147, 679, 501
Chandler project	14, 244, 157	10, 547, 766	3, 696, 391
The Dalles project	217, 302, 021	21, 078, 411	196, 223, 610
Total plant	2, 001, 035, 077	490, 617, 645	1, 510, 417, 432
Less combined reserve for depreciation			110, 887, 645
Total less reserve			1, 399, 529, 787

Project	Power capital investment [1]	Repaid as of June 30, 1957	Percent repaid	Net power investment [1]
Bonneville Power Administration	$440, 140, 333	$112, 143, 555	25. 48	$327, 996, 778
Bonneville Dam	59, 883, 099	25, 904, 231	43. 26	33, 978, 868
Columbia Basin project	207, 365, 383	58, 513, 519	28. 22	148, 851, 864
Hungry Horse	87, 513, 455	5, 939, 161	6. 79	81, 574, 294
Albeni Falls	30, 948, 092	1, 060, 769	3. 43	29, 887, 323
McNary	277, 459, 591	16, 999, 126	6. 13	260, 460, 465
Detroit-Big Cliff	41, 820, 544	2, 701, 807	6. 46	39, 118, 737
Lookout Point-Dexter	41, 396, 107	1, 779, 816	4. 30	39, 616, 291
Chief Joseph	146, 564, 404	1, 552, 355	1. 06	145, 012, 049
Chandler	3, 691, 747	201, 886	5. 47	3, 489, 861
The Dalles	193, 445, 851	28, 479	. 01	193, 417, 372
Total	1, 530, 228, 606	226, 824, 704	[2] 14. 82	1, 303, 403, 902

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[1] Exclusive of unexpended funds in U. S. Treasury.

[2] This overall total of 14.82 percent is less than the corresponding result of 15.68 percent shown as of the end of the preceding fiscal year because of the inclusion of The Dalles project, representing a very substantial investment but with practically no commercial operations in 1957. In fact, only the 2 small fishway units were in commercial service in 1957 and even these were on the line for only a few weeks. Exclusive of The Dalles project, the overall percentage for this table would be 16.97 percent. For every project in the list other than The Dalles, the percentage of repayment increased over the corresponding amount a year earlier.

The data in this table are based on cost accounts maintained in accordance with the Federal Power Commission uniform system of accounts.

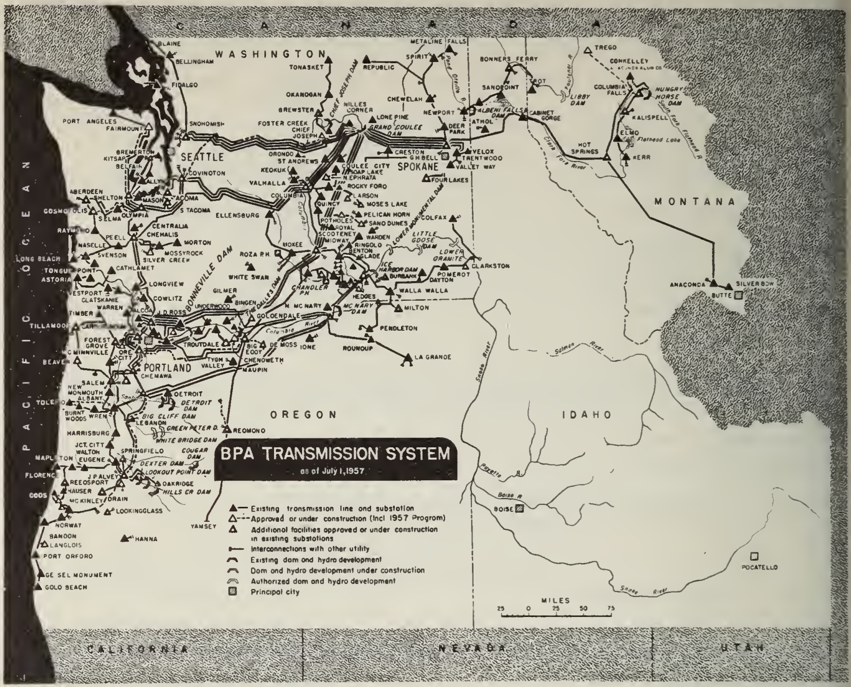

FIGURE 6.

SUMMARY OF OPERATIONS

Energy Production

Almost 30 billion kilowatt-hours of electric energy were generated at the 12 Federal plants for the Administration during fiscal year 1957. This was an increase of 8.6 percent over fiscal year 1956. One new plant, The Dalles, was connected to the system during the year. In addition, six new units at Chief Joseph and two at McNary were brought into production during the year.

New System Peak

A new system peak was established during the 6–7 p. m. hour on January 25, 1957, before The Dalles plant, the eighth and ninth units at Chief Joseph, and the last two units at McNary were in operation. Maximum coincident demand on the 11 Federal plants was 4,887,000 kilowatts, an increase of 9.1 percent over the previous fiscal year's maximum demand of 4,479,000 kilowatts, which occurred on February 1, 1956. Energy produced at Federal plants for the Administration is shown by years in table VI and illustrated in the accompanying chart. Prepared on a quarterly basis, the chart shows the general trends of the Bonneville Power Administration's system-load growth.

TABLE VI.—*Generation at Federal plants for the Bonneville Power Administration, fiscal years 1939–57*

BY FISCAL YEARS

Fiscal years ending June 30	Generation (thousands of kilowatt-hours)	Maximum demand (kilowatts)	Load factor (percent)
1939–41	1, 144, 932	210, 000	----------
1942	2, 549, 153	468, 000	62. 2
1943	5, 618, 436	841, 000	76. 3
1944	9, 239, 823	1, 355, 000	77. 6
1945	9, 051, 573	1, 427, 000	72. 4
1946	6, 236, 163	1, 346, 000	52. 9
1947	8, 753, 737	1, 335, 000	74, 9
1948	10, 885, 907	1, 610, 000	77. 0
1949	12, 925, 788	1, 797, 000	82. 1
1950	14, 140, 834	2, 106, 000	76. 7
1951	16, 472, 384	2, 535, 000	74. 2
1952	18, 555, 401	2, 784, 000	75. 9
1953	17, 633, 232	2, 867, 000	70. 2
1954	20, 195, 833	3, 301, 000	69. 8
1955	23, 253, 186	3, 651, 000	72. 7
1956	27, 599, 380	4, 479, 000	70. 1
1957	29, 984, 224	4, 887, 000	70. 0
Total	234, 239, 986	4, 887, 000	----------

BY PLANTS

	Generation [1] (millions of kilowatt-hours)		Date in service [2]	Operating agency
	Fiscal year 1957	Total to July 1, 1957		
Albeni Falls	253	511	Mar. 25, 1955	Army Engineers.
Bonneville	4, 089	60, 164	June 6, 1938	Do.
Chandler	65	91	Feb. 13, 1956	USBR.
Chief Joseph	4, 321	6, 235	Aug. 20, 1955	Army Engineers.
Detroit [3]	407	1, 645	July 1, 1953	Do.
Big Cliff	101	307	June 12, 1954	Do.
Grand Coulee [4]	13, 158	144, 042	Sept. 28, 1941	USBR.
Hungry Horse	894	3, 864	Oct. 29, 1952	Do.
Lookout Point [3]	386	1, 007	Dec. 16, 1954	Army Engineers.
Dexter	72	168	May 19, 1955	Do.
McNary	6, 223	16, 191	Nov. 6, 1953	Do.
The Dalles	15	15	May 13, 1957	Do.
Total	29, 984	234, 240		

[1] Includes energy generated in testing new generating units.
[2] Date of commercial operations.
[3] Excludes energy for condenser power at Detroit and Lookout Point.
[4] Includes energy transferred for Bureau of Reclamation.

Receipts and Deliveries

Bonneville Power Administration's transmission grid forms the backbone of the interconnected transmission system of public and private utilities in the Pacific Northwest. As a result, electric energy receipts and deliveries on Bonneville's transmission system cover many complex transactions in addition to receipts from Federal power plants and deliveries by sales.

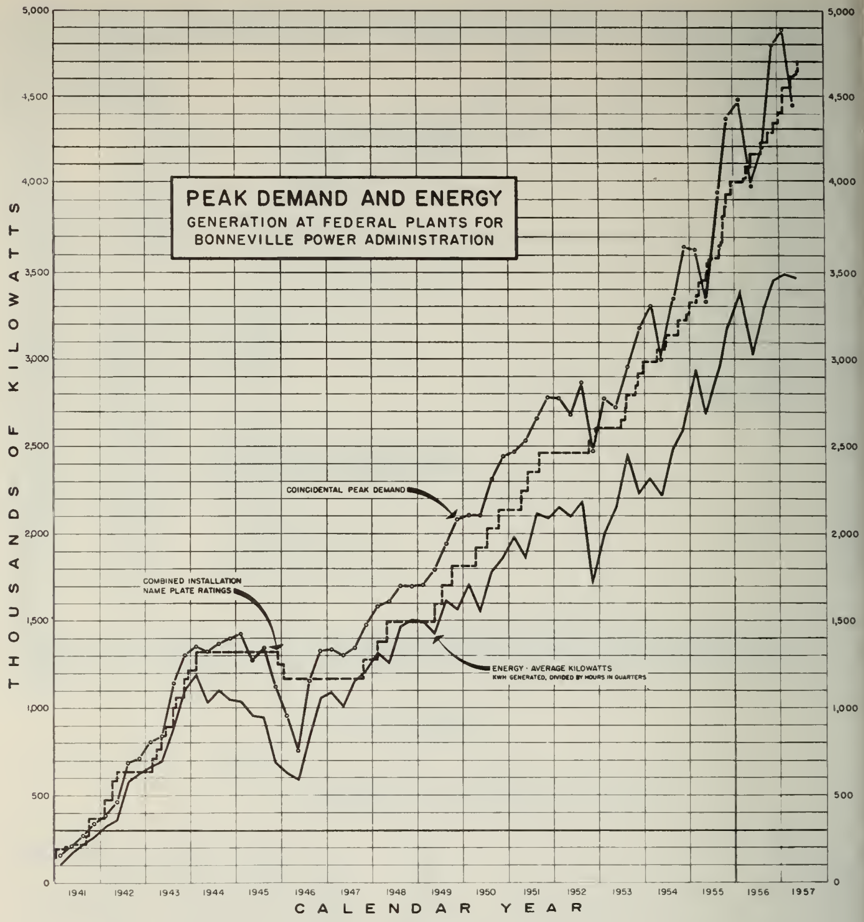

FIGURE 7.

The integrated transmission grid makes possible the fullest utilization of power facilities in the area through diversity in peaking and water capabilities and diversity of system-load conditions. Substantial quantities of energy are received and delivered as transfers from other utilities.

Transactions also involve storage by the Administration in non-Federal reservoirs as well as storage by non-Federal utilities in the Grand Coulee Reservoir. Disposition of energy includes deliveries from storage in Grand Coulee or to storage in other reservoirs, energy transfers for the Bureau of Reclamation from Grand Coulee, energy used by the Administration, and energy losses in transmission and transformation.

Table VII, electric energy account, summarizes energy receipts and deliveries for fiscal year 1957.

TABLE VII.—*Electric energy account for fiscal year 1957*

Energy received (millions of kilowatt-hours):	
Energy generated at Federal plants for BPA[1]	29, 984
Power purchased and interchanged in	4, 284
Total received	34, 268
Energy delivered (millions of kilowatt-hours):	
Sales	28, 216
Power interchanged out	4, 084
Used by Administration	31
Total delivered	32, 331
Energy losses in transmission and transformation	1, 937
Losses as percent of total energy received—percent	5.7
Maximum demand on generating plants (kilowatts), January 25, 1957, 6–7 p. m., Pacific standard time	4, 887, 000
Load factor, total generated for BPA, percent	70.0

[1] For detail by plants, see table VI.

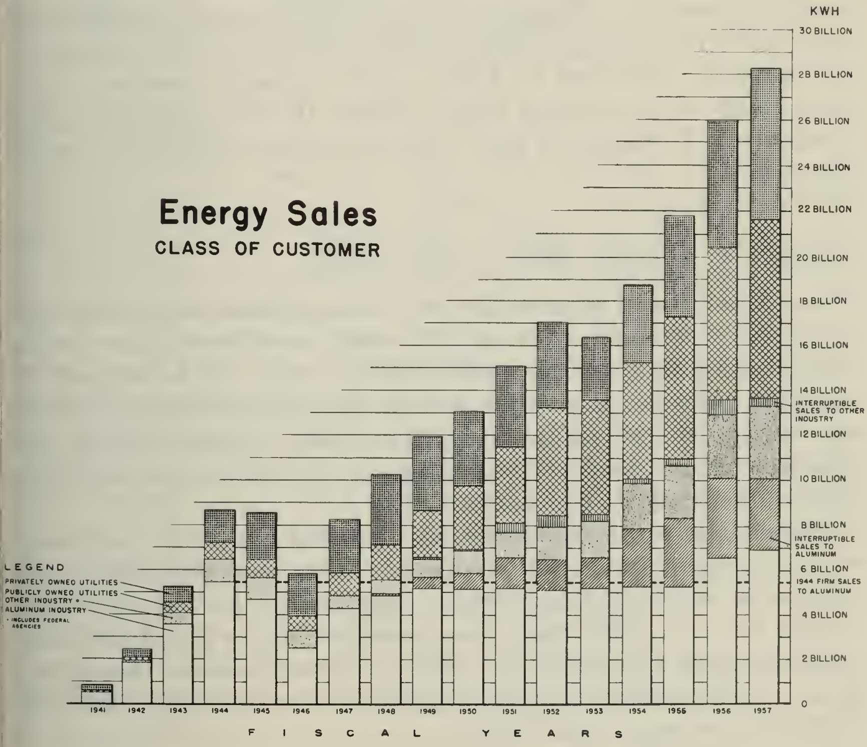

FIGURE 8.

Sale of 28 Billion Kilowatt-Hours

Energy sales to customers of the Bonneville Power Administration totaled 28 billion kilowatt-hours during the fiscal year 1957, an increase of 8.6 percent over 1956.

Sales of electric energy to other utilities, both publicly and privately owned, totaled 14.5 billion kilowatt-hours, an increase of 17.2 percent. Deliveries to industrial plants and Federal agencies totaled 13.7 billion kilowatt-hours, an increase of 0.8 percent.

During fiscal year 1957, BPA supplied 3.5 billion kilowatt-hours of interruptible energy to industrial customers. This was 82 percent of what these customers would have purchased had total requirements been available, and a decrease of 14.3 percent from fiscal year 1956 deliveries of interruptible energy. The power resources during the winter were inadequate and required a reduction in deliveries of interruptible energy to the industrial customers in order to meet the Administration's firm power commitments and requirements of higher priority customers.

The 3.5 billion kilowatt-hours of interruptible energy sales include 351 million kilowatt-hours and $703,235 provisional sales to 13 industrial customers. These provisional sales were made possible by generation from storage releases beyond normal operating drawdown of reservoirs. Revenues are held in special deposit accounts to cover replacement of provisional energy during the next two fiscal years if required. During fiscal year 1956 there were no provisional energy sales.

Composite Average Rate of 2.37 Mills

The Administration has sold 218.6 billion kilowatt-hours of electric energy at a composite rate of 2.37 mills per kilowatt-hour during the 19 years of operation ended June 30, 1957. Sales to publicly owned utilities for the 19 years were 49.9 billion kilowatt-hours at an average of 2.80 mills. Privately owned utilities received 49.6 billion kilowatt-hours at an average of 2.29 mills, and industries 119.1 billion kilowatt-hours at 2.22 mills.

Power sales to aluminum plants were 95.2 billion kilowatt-hours at an average of 2.11 mills. These plants characteristically take power at very high load factors, approaching 100 percent, which results in the exceptionally low average cost on the Administration's C and A rate schedules. Sales to industries other than aluminum, including sales to Federal agencies, were 23.9 billion kilowatt-hours at an average of 2.63 mills.

TABLE VIII.—*Electric energy sales by class of customer, fiscal years 1939–57*

[Millions of kilowatt-hours]

Fiscal years ending June 30	Aluminum	Other industries [1]	Publicly owned utilities	Privately owned utilities	Total
1939-41	523	5	35	537	1, 100
1942	1, 845	79	143	358	2, 425
1943	3, 589	507	435	739	5, 270
1944	5, 454	1,022	728	1, 467	8, 671
1945	4, 667	965	824	2,057	8, 513
1946	2, 492	800	636	1, 903	5, 831
1947	4, 212	627	1,045	2, 378	8, 262
1948	4, 902	647	1, 561	3, 181	10, 291
1949	5, 666	881	2, 081	3, 342	11,970
1950	5, 863	1,024	2, 840	3, 312	13,039
1951	6, 545	1, 538	3, 414	3, 579	15. 076
1952	6, 472	1, 943	4, 804	3, 794	17,013
1953	6, 547	1, 947	5, 110	2, 791	16, 395
1954	[2] 7, 862	2, 254	5, 127	3, 531	[2] 18, 774
1955	[2] 8, 352	2, 624	6, 274	4, 578	[2] 21, 828
1956	10, 140	3, 422	6, 909	5, 500	25. 971
1957	[2] 10,096	[2] 3, 581	7, 970	6, 569	[2] 28, 216
Total to July 1, 1957	[2] 95, 227	[2] 23, 866	49, 936	49, 616	[2] 218, 645

[1] Includes Federal agencies.

[2] Includes provisional energy sales to industries:

	Aluminum	Other industries
Fiscal year:		
1954	28,355 mwh	
1955	22,956 mwh	
1957	323,509 mwh	27,817 mwh.

Rate Schedules

During the last fiscal year almost three-quarters of the energy sales were made under the C–4 wholesale rate schedule at an average rate of 2.12 mills per kilowatt-hour. This is the kilowatt-year rate for firm power delivered anywhere from the transmission system, and is also used with special measured demand provisions for sales of interruptible power. Sales are generally made under this rate to industries operating at high load factor and to utilities having substantial generating facilities. Other sales were made principally under the E–4 rate schedule to utilities purchasing all or substantially all of their power requirements from the Administration. At-site power is sold under the A–4 rate. Sales under the F–4 schedule were made to the utilities and industries requiring power at low-load factor use, and under the H schedule for dump, exchange, or experimental purposes. A summary of energy sales for the fiscal year 1957 classified by rate schedules is shown in table IX.

A special review of the Administration's rate structure by the Ford, Bacon & Davis Co. was completed during the 1956 fiscal year. Study of this special report by the staff was continued during this last year.

Special study by the staff was directed during fiscal year 1957 to review of the Administration's entire present wholesale rate structure and to development of a rate by which low availability secondary energy in excess of that sold under present rates can be marketed.

TABLE IX.—*Electric energy sales by rate schedules during fiscal year 1957*

Rate schedule	Energy (thousands of kilowatt-hours)	Revenue [1]	Mills per kilowatt-hour
C-4:			
Industries	[2] 12,352,068	[2] $25,942,951	2.10
Utilities	8,530,229	18,352,171	2.15
Subtotal	20,882,297	44,295,122	2.12
F-4:			
Industries	14,298	63,487	4.44
Utilities	65,928	290,059	4.40
Subtotal	80,226	353,546	4.41
A-4:			
Industries	[2] 1,081,214	[2] 1,807,016	1.67
Utilities	11,818	43,947	3.72
Subtotal	1,093,032	1,850,963	1.69
E-4: Utilities [3]	4,315,673	13,649,520	3.16
Experimental, H-3 and exchange: Industries and utilities	1,844,964	4,612,410	2.50
Total	[2] 28,216,192	[2] 64,761,561	2.30

[1] These revenues from sale of electric energy differ from official accounting records in that billing adjustments applicable to only fiscal year 1957 are included.

[2] Includes provisional sales·

	Energy (thousands of kwh.)	Revenue
C-4	333,207	$673,028
A-4	18,119	30,207
	351,326	703,235

[3] Including Federal agency pumping loads.

Customers Served

The Administration was serving 114 customers during the fiscal year 1957 with no changes during the year. There were 76 publicly owned distributors of power, 18 industrial customers, 11 Federal agencies, and 9 privately owned utilities.

In order to improve services to these customers, 11 points of delivery were added during the year, bringing the total number of delivery points to 345 at the end of the 1957 fiscal year.

Generation Added

Additions to the United States Columbia River power system in fiscal year 1957 have a nameplate rating of 551,000 kilowatts. The final two units with 140,000 kilowatts total capacity were installed at the McNary project on the Columbia River. Six units with a total capacity of 384,000 kilowatts were installed at Chief Joseph project on the Columbia River, leaving six units to be installed for the completed project. Two units in the fishway at The Dalles project with a total capacity of 27,000 kilowatts were installed. The Corps of Engineers is construction agency for all three of these projects.

Projects Summarized

Projects existing, under construction, and authorized for construction by the Corps of Engineers and Bureau of Reclamation are shown in table X. The existing projects and units installed to date in projects under construction will provide 3,584,000 kilowatts of prime power when operated as a system. With completion of the projects under construction the prime capability will be 5,394,000 kilowatts and with completion of the authorized projects prime capability will be over 6 million kilowatts.

Existing storage capacity usable for power in Federal reservoirs is 9,868,500 acre-feet. An additional 403,000 acre-feet will be provided by Cougar and Hills Creek on which construction is under way, and 5,343,000 acre-feet would be provided by Libby and Green Peter projects which are authorized for construction.

All generation and storage capacity, except the John Day project, will be in service by December 1961 under the present schedule. John Day project will be completed by June 1967. Service dates for the other authorized projects are not scheduled as no funds have been appropriated for their construction.

Non-Federal Additions

Non-Federal generating capacity in the area served by the Administration was increased in fiscal year 1957 by installation of the last of four units at Ross project by Seattle City Light. This unit, which has a nameplate rating of 90,000 kilowatts, began operation on November 19, 1956.

TABLE X.—*U. S. Columbia River power system, general specifications, November 15, 1957—projects existing, under construction, and authorized—installations and capabilities correspond to a coordinated system operation*

Project	Location	Stream	Plant installations		Nominal prime power (kilowatts)[2]	Pool elevation (feet)	Usable storage (acre-feet)[4]	Average head (feet)	Date in service		Principal purpose[5]
			Number of units	Total capacity (kilowatts)[1]					Initial unit	Last unit	
Existing:											
Bonneville	Washington-Oregon	Columbia	10	518, 400	466, 000	74	Pondage	58	June 1938	December 1943	P, N.
Grand Coulee	Washington	do	18	1, 944, 000	1, 552, 000	1, 288	5, 072, 000	315	September 1941	September 1951	P, I, FC, N.
Hungry Horse	Montana	South Fork Flathead.	4	285, 000	186, 000	3, 560	2, 982, 000	376	October 1952	July 1953	P, I, FC. N.
Detroit	Oregon	North Santiam	2	100, 000	39, 000	1, 563. 5	323, 000	285	July 1953	October 1953	P, I, FC, N.
McNary	Washington-Oregon.	Columbia	14	980, 000	549, 000	340	Pondage	80	November 1953	February 1957	P, I, N.
Big Cliff	Oregon	North Santiam	1	18, 000	11, 000	1, 206	Pondage	91	June 1954	June 1954	P.
Lookout Point	do	Middle Fork Willamette.	3	120, 000	34, 000	926	336, 500	185	December 1954	April 1955	P, I, FC, N.
Albeni Falls	Idaho	Pend Oreille	3	42, 600	21, 000	2, 062. 5	1, 155, 000	16	March 1955	August 1955	P, FC, N.
Dexter	Oregon	Middle Fork Willamette.	1	15, 000	11, 000	695	Pondage	53	May 1955	May 1955	P.
Chief Joseph	Washington	Columbia	12	768, 000	768, 000	946	Pondage	177	August 1955	October 1957	P, I.
Chandler	do	Yakima	2	12, 000	11, 000	618. 5		118	February 1956	February 1956	P, I.
The Dalles	Washington-Oregon.	Columbia	4	183, 000	156, 000	160	Pondage	86	May 1957	November 1957	P, N.
				4, 986, 000	3, 804, 000		9, 868, 500				
Under construction:											
Chief Joseph	Washington	do	4	256, 000	88, 000	946	Pondage	177	January 1958	December 1958	P, I.
The Dalles	Washington-Oregon.	do	12	936, 000	518, 000	160	Pondage	86	February 1958	November 1960	P, N.
Roza	Washington	Yakima	1	11, 250	6, 000	1, 220. 6	Pondage	140	May 1958	May 1958	P, I.
Cougar	Oregon	South Fork McKenzie.	2	25, 000	17, 000	1, 690	154, 000	350	November 1961	November 1961	P, I, FC, N.
Hills Creek	do	Middle Fork Willamette.	2	30, 000	16, 000	1, 543	249, 000	210	November 1961	November 1961	P, I, FC, N.
Ice Harbor	Washington	Snake	3	270, 000	171, 000	440	Pondage	97	December 1961	December 1961	P, I, N.
John Day	Washington-Oregon.	Columbia	12	1, 200, 000	774, 000	262	Pondage	101	October 1965	June 1967	P, I, FC, N.
				2, 728, 250	1, 590, 000		403, 000				

Authorized:											
Libby	Montana	Kootenai	6	516,000	257,000	2,459	5,010,000	265			P, FC, N.
Lower Monumental.	Washington	Snake	3	270,000	169,000	533	Pondage	92			P, I, N.
Little Goose	do	do	3	270,000	180,000	633	Pondage	99			P, N.
Lower Granite	do	do	3	225,000	146,000	715	Pondage	80			P, N.
Green Peter	Oregon	Middle Santiam	2	81,000	22,000	984	333,000	250			P, I, FC, N.
White Bridge	do	do	1	15,000	9,000	670	Pondage	90			P.
				1,377,000	783,000 3—31,000		5,343,000				
Total, 23 projects.				9,091,250	6,146,000		15,614,500				

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[1] Nameplate rating.

[2] Average capability in a coordinated system during an 8-month storage release period (September 1936 through April 1937).

[3] Pumping requirements of 31,000 kw. represents the average power necessary to supply that part of irrigation water at Grand Coulee during the storage release period for 600,000 acres of the Columbia Basin project.

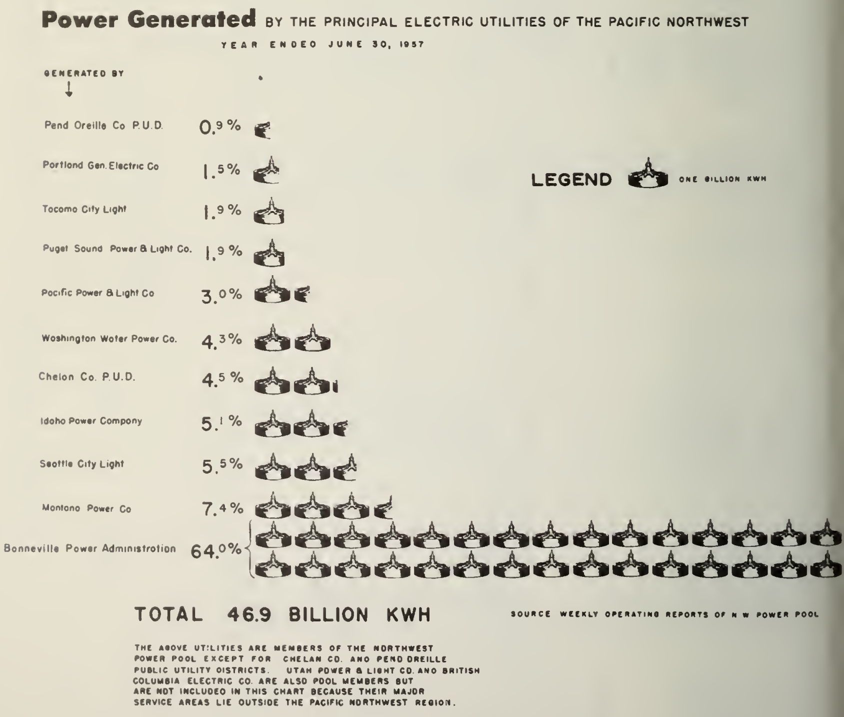
[4] Storage usable for power production.

[5] P—Power; I—Irrigation; FC—Flood control; N—Navigation.

The Puget Sound Power & Light Co. added unit No. 7 of 20,000 kilowatts at the Snoqualmie Falls plant shortly after the close of fiscal year 1957. Future additions licensed for construction by non-Federal utilities in this area are shown in table XI. These additions represent an increase of 410,000 kilowatts of nameplate rating over projects in a comparable status one year previously.

Northwest Power Pool

Generation by the principal electric utility systems of the Pacific Northwest during the fiscal year 1957 is shown in table XII. All utilities listed are members of the Northwest power pool with the exceptions of the Chelan County and Pend Oreille County Public Utility Districts. These two utilities are included because they provided substantial amounts of generation to the pool. The Utah Power & Light Co. and the British Columbia Electric Co. are members of the pool but are not included as their major service areas are outside the region.



Power Generated BY THE PRINCIPAL ELECTRIC UTILITIES OF THE PACIFIC NORTHWEST

YEAR ENDED JUNE 30, 1957

SOURCE WEEKLY OPERATING REPORTS OF N W POWER POOL

THE ABOVE UTILITIES ARE MEMBERS OF THE NORTHWEST POWER POOL EXCEPT FOR CHELAN CO. AND PEND OREILLE PUBLIC UTILITY DISTRICTS. UTAH POWER & LIGHT CO. AND BRITISH COLUMBIA ELECTRIC CO. ARE ALSO POOL MEMBERS BUT ARE NOT INCLUDED IN THIS CHART BECAUSE THEIR MAJOR SERVICE AREAS LIE OUTSIDE THE PACIFIC NORTHWEST REGION.

FIGURE 9.

A total of 64.0 percent of the energy generated by the major utili- es of the region was produced by the United States Columbia River ower system. In addition to power requirements of utilities and ajor industries served through the Administration's transmission ystem, 8.6 billion kilowatt-hours of energy were provided to other ool utilities for meeting their requirements.

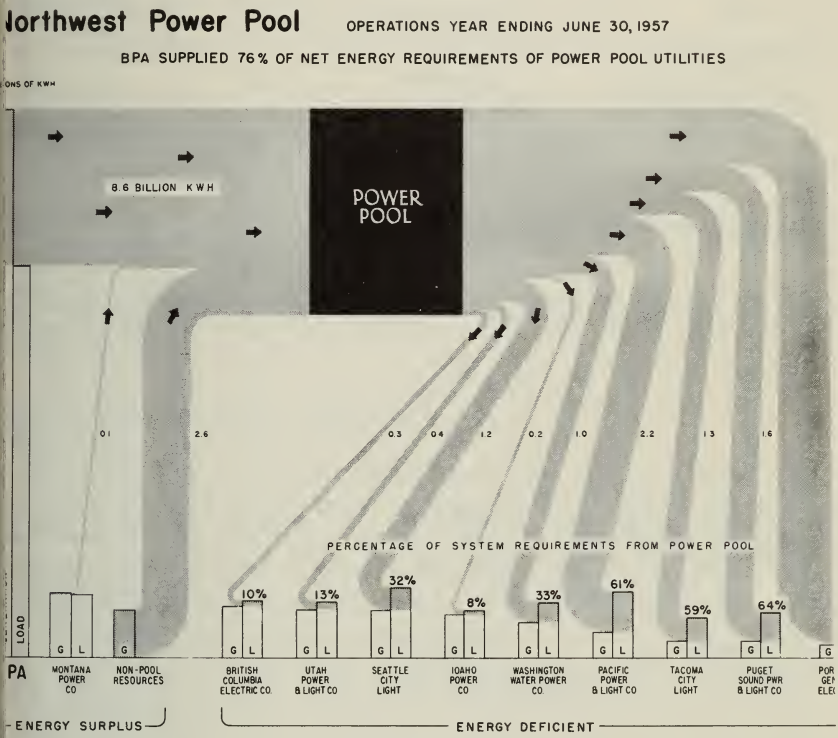


FIGURE 10.

TABLE XI.—*Non-Federal utilities generator installation schedule, Aug. 12, 1957*

Utility and plant	Stream	Unit No.	Nameplate rating (thousands of kilowatts)	Date in service
Portland General Electric Co.:				
Pelton	Deschutes River	1	36	November 1957.
		2	36	January 1958.
		3	36	February 1958.
North Fork	Clackamas River	1	19.2	July 1958.
		2	19.2	September 1958.
Faraday (addition)	do	6	19.2	November 1958.
City of Seattle:				
Diablo (reconstruction)	Skagit River	1 and 2	(1)	August 1958.
Gorge (reconstruction)	do		(2)	August 1959.
Pacific Power & Light Co.:				
Merwin (addition)	Lewis River	3	45	December 1958.
Swift No. 1	do	1, 2, and 3.	204	December 1958.
Cowlitz County Public Utility District:				
Swift No. 2	do	1 and 2	70	December 1958.
Grant County Public Utility District:				
Priest Rapids	Columbia River	1	78.85	April 1959.
		2	78.85	June 1959.
		3	78.85	August 1959.
		4	78.85	October 1959.
		5	78.85	December 1959.
		6	78.85	February 1960.
		7	78.85	April 1960.
		8	78.85	June 1960.
Wanapum	do	1	75	May 1962.
		2	75	July 1962.
		3	75	September 1962.
		4	75	November 1962.
		5	75	January 1963.
		6	75	March 1963.
		7	75	May 1963.
		8	75	July 1963.
Puget Sound Power & Light Co.:				
Upper Baker	Baker River	1 and 2	85	September 1959.
Lower Baker (addition)	do	3	55	September 1960.
Washington Water Power Co.:				
Noxon Rapids	Clark Fork	1	84	September 1959.
		2	84	December 1959.
		3	84	March 1960.
		4	84	June 1960.
City of Eugene:				
Beaver Marsh	McKenzie River	1 and 2	30	July 1960.
City of Tacoma:				
Mayfield	Cowlitz River	1	40	October 1960.
		2	40	January 1961.
		3	40	April 1961.
		4	40	July 1961.
Mossyrock	do	1	75	April 1963.
		2	75	July 1963.
		3	75	October 1963.
		4	75	December 1963.
Chelan County Public Utility District:				
Rocky Reach	Columbia River	1	101.65	July 1961.
		2	101.65	August 1961.
		3	101.65	September 1961.
		4	101.65	November 1961.
		5	101.65	January 1962.
		6	101.65	March 1962.
		7	101.65	May 1962.

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[1] Reconstruction of the turbines will increase peaking capability by 25,000 kilowatts.

[2] Reconstruction of diversion dam will increase gross head by 100 feet and peaking capability by 57,000 kilowatts.

TABLE XII.—*Generation by the principal electric utility systems of the Pacific Northwest, fiscal year 1957* [1]

Utilities	Kilowatt-hours (billion)	Percent of total generation
Publicly owned:		
Bonneville Power Administration	30.0	64.0
Seattle City Light	2.6	5.5
Chelan County Public Utility District	2.1	4.5
Tacoma City Light	.9	1.9
Pend Oreille County Public Utility District	.4	.9
Total publicly owned	36.0	76.8
Privately owned:		
Montana Power Co	3.5	7.4
Idaho Power Co	2.4	5.1
Washington Water Power Co	2.0	4.3
Pacific Power & Light Co	1.4	3.0
Puget Sound Power & Light Co	.9	1.9
Portland General Electric Co	.7	1.5
Total privately owned	10.9	23.2
Total generation	46.9	100.0

[1] Generation shown is for members of the Northwest power pool plus Chelan County and Pend Oreille County Public Utility Districts. Utah Power & Light Co. and British Columbia Electric Co. who are members of the power pool are not included because their service areas lie outside the Pacific Northwest region.

Transmission System Additions

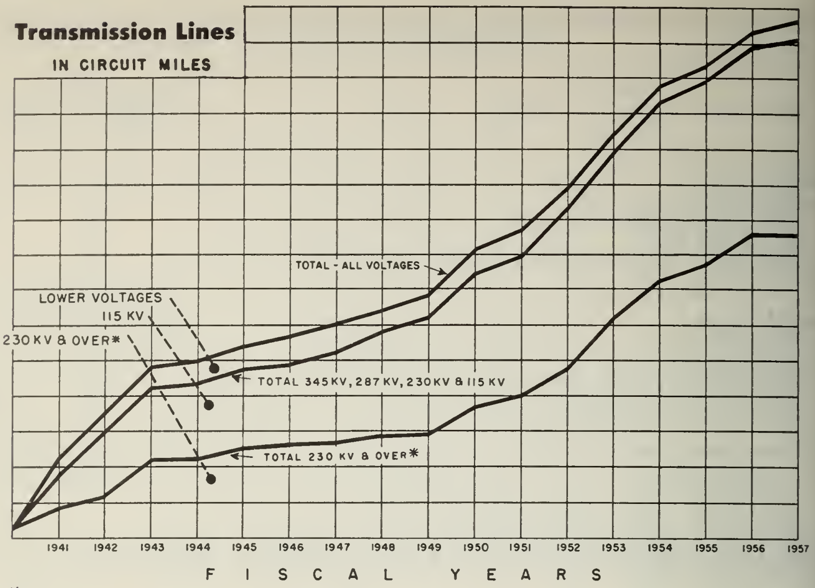
Bonneville Power Administration grid was increased during the fiscal year to 7,318 circuit miles of transmission line and 183 substations with a transformer capacity of 10,775,915 kilovolt-amperes.

Total circuit miles of transmission line include 175 of 345,000 volts, 231 of 287,000 volts, 3,884 of 230,000 volts, 2,795 of 115,000 volts, and 233 circuit miles of lower voltage lines.

Six new substations ranging from 3,000 to 250,000 kilovolt-amperes were energized during the year, one was retired, and transformers, including force-cooling equipment, ranging from 3,000 to 600,000 kilovolt-amperes was added to 24 existing substations. These additions increased the transformer capacity of the system by 2,767,165 kilovolt-amperes, or 35 percent.

Construction Program

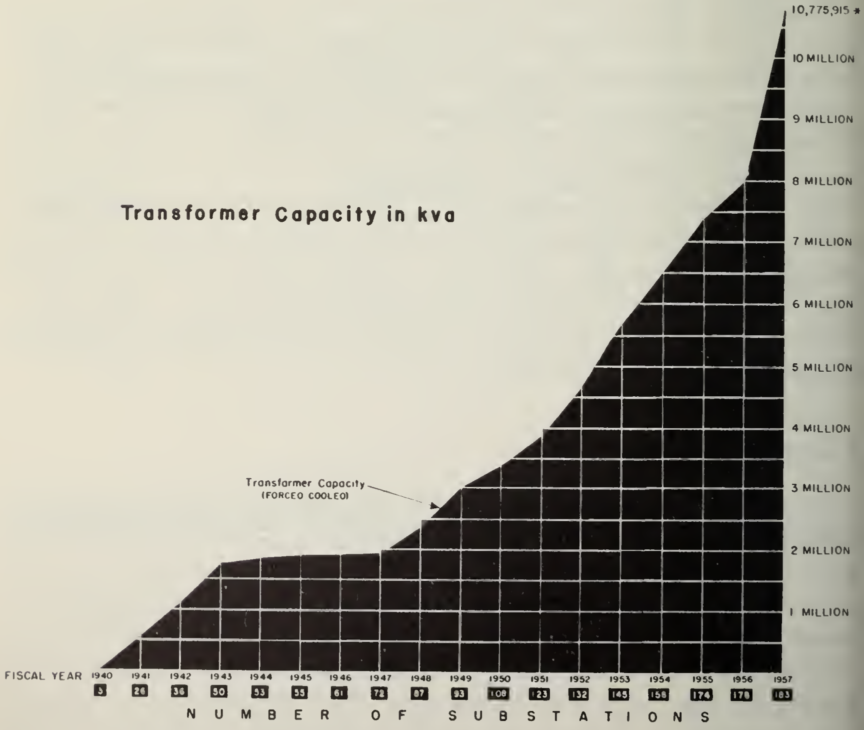
Major grid additions completed during the fiscal year include the McNary-J. D. Ross 345,000 volt transmission line and 600,000 kilovolt-ampere autotransformer banks, serving Portland-Vancouver load centers; the J. D. Ross-Keeler transmission line and 250,000 kilovolt-ampere Keeler substation serving Portland and upper Willamette Valley; a 250,000 kilovolt-ampere transformer bank at Big Eddy substation for service to The Dalles area; the Olympia-Shelton 230,000 volt transmission line and 250,000 kilovolt-ampere transformer bank No. 2 at Olympia substation, serving the Olympic Peninsula; a



*INCLUDES 2305 MILES 287 KV & 174.7 MILES 345 KV

Note: VOLTAGES SHOWN ARE OPERATING VOLTAGES

FIGURE 11.



* INCLUDES 1,600,000 KVA OF AUTOTRANSFORMERS OPERATED AS PART OF TRANSMISSION LINES

FIGURE 12.

250,000 kilovolt-ampere transformer bank at Columbia substation, serving the north central Washington area, and the McNary-Franklin 230,000 volt transmission line for service to the Pasco-Richland-Walla Walla area.

Work progressed on schedule on a number of important grid additions under way at the beginning of the fiscal year and continuing into the new fiscal year. These include the Big Eddy-Oregon City-Chemawa 230,000-volt transmission line, reinforcing the power supply to the Willamette Valley; the Alvey-Reston-Fairview 230,000-volt transmission line to augment power flows to southwest Oregon; the Big Eddy-Chenowith-Harvey 115,000-volt circuits to serve the Harvey Machine Co. aluminum plant; the Chief Joseph-Covington 345,000-volt transmission line, reinforcing service to the Puget Sound and Olympic Peninsula areas, and the Chief Joseph-Snohomish 345,000-volt transmission line to supply added service to the Seattle and North Puget Sound area.

New construction begun during the fiscal year included the Redmond-Round Butte 230,000-volt transmission line, to integrate new Co. with the BPA grid on a wheeling basis, and a 250,000 kilovolt-ampere Franklin substation addition for expanded service to the Pasco-Richland-Walla Walla area.

SOUTHWESTERN POWER ADMINISTRATION

Douglas G. Wright, *Administrator*

FOR THE FISCAL YEAR 1957, Southwestern Power Administration received $1 million in direct appropriations for its operation and maintenance program, and authorization by the Congress making available $6,400,000 out of receipts, for all costs in connection with the purchase of power and energy, and rentals for the use of transmission facilities. Additional funds in the amount of $1,052,10 remained available for completion of the Administration's construction program.

Power Resources

The installed capacity and capability in the hydroelectric and steam plants in the integrated system as of June 30, 1957, is shown in the following table.

Project or plant	River basin	Installed capacity	Capability (June 30, 1957)
Hydroelectric:			
Interconnected system:		*Kilowatts*	*Kilowatts*
Bull Shoals	White	160,000	184,00
Denison	Red	70,000	80,00
Fort Gibson	Grand	45,000	48,00
Norfork	White	70,000	80,00
Tenkiller Ferry	Illinois	34,000	39,00
Subtotal		379,000	431,00
Isolated plants:			
Blakely Mountain	Ouachita (Red)	75,000	75,00
Narrows	Little Missouri	17,000	17,00
Whitney	Brazos	30,000	30,00
Subtotal		122,000	122,00
Total hydroelectric		501,000	553,00
Steam:			
Western Farmers Electric Cooperative		30,000	30,00
Central Electric Power Cooperative		15,000	16,00
N. W. Electric Power Cooperative		40,000	42,00
Total steam		85,000	88,00
Grand total		586,000	641,00

This capacity of 501,000 kilowatts will be increased by 100,000 kilo-atts when Table Rock project on the White River comes into pro-luction, which is presently scheduled for early 1959. A further ncrease of 180,000 kilowatts will be accomplished by 1961 with com-letion of the 200,000 kilowatt installation at Table Rock and the ad-lition of 80,000 kilowatts at Bull Shoals.

ENERGY PRODUCTION

ydroelectric Projects

The adverse water conditions which have existed in the Southwest-rn Power Administration area since May 1952, although partially lleviated during the first 6 months of 1955, were even more critical luring the period July through December 1956. The reservoir sys-em has experienced below median flow for 47 months of the past 5 ears. Stream flow conditions improved in February and March 957. During the 3-month period, April, May, and June 1957, ex-essively high rainfall with resultant flood runoff not only filled the ower pools of the projects but, without exception, produced new aximum pool elevations of record.

Project and State	Stream	Percent of median flow		
		July 1, 1952 to June 30, 1955	July 1, 1955 to June 30, 1956	July 1, 1956 to June 30, 1957
lakely Mountain, Arkansas	Ouachita			151
ull Shoals, Arkansas	White	69	76	186
enison, Texas-Oklahoma	Red	94	91	229
ort Gibson, Oklahoma	Grand	35	44	157
orfork, Arkansas	North Fork	68	78	157
enkiller, Oklahoma	Illinois	76	44	206
arrows, Arkansas	Little Missouri	100	101	143
hitney, Texas	Brazos		95	299
Total system		65	71	179

Total stream flow for the fiscal year as shown in the above table as above normal and pools at the end of the year were at ex-eptionally high elevations. Eighty-five percent of the total volume f flow for the system during the past fiscal year occurred in the last uarter. Secondary energy was generated for 26 days in March nd continuously through the last quarter of the year. The total et generation for the year is approximately double the annual pri-ary energy. The energy in excess of primary generation was mar-eted as secondary and dump. It is expected that secondary energy ill be available during the first quarter of the next fiscal year from tored flood waters.

Net hydroelectric generation available to Southwestern Power Administration during the 1957 fiscal year was 1,464,971,500 kilowatt-hours, of which 1,134,739,300 kilowatt-hours were from the interconnected system. The net generation for the past fiscal year and the annual primary energy for each project is given below.

Project	Net generation (kilowatt-hours)		
	Apr. 1, 1957–June 30, 1957	Percent of fiscal year	1957 fiscal year total
Interconnected system:			
Bull Shoals	314, 564, 000	48	651, 472. 000
Denison	99. 710, 000	69	144, 502, 000
Fort Gibson	45, 767, 900	63	72, 589, 000
Norfork	131, 520, 300	64	204, 285, 300
Tenkiller Ferry	39, 912, 100	64	61, 891, 000
Subtotal	631, 474, 300	56	1, 134, 739, 300
Isolated plants:			
Blakely Mountain	145, 991, 000	67	219, 259, 000
Narrows	26, 721, 740	67	39, 821, 200
Whitney	50, 028, 000	70	71, 152, 000
Subtotal	222. 740, 740	67	330, 232, 200
Total	854, 215. 040	58	1, 464, 971, 500

Steam Plants

The amounts of energy generated by these plants for marketing during fiscal year 1957 are shown in the following table:

Plant:	*Net generation (kilowatt hours)*
Western Farmers Electric Cooperative (Anadarko)	178, 176, 000
Central Electric Power Cooperative (Chamois)	93, 898, 000
N. W. Electric Power Cooperative (Missouri City)	236, 678, 000
Total	508, 752, 000

MARKETING

During the fiscal year 1957 billing period, the Southwestern Power Administration had available for sale a total of 1,966.6 million kilowatt-hours of energy, of which 717.9 million kilowatt-hours represented purchases or withdrawals[1] and 1,248.7 million kilowatt-hours represented hydroelectric generation. Of the total 1,875.9 million kilowatt-hours marketed, after losses, 1,479.8 million kilowatt-hours represented primary and firm energy, while 396.1 million kilowatt-hours represented secondary energy. Energy deliveries to preferred customers amounted to 1,298.9 million kilowatt-hours, equivalent to

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[1] Represents generation adjusted to billing periods, without Blakely Mountain contract withdrawals, which are shown under purchases or withdrawals.

104.0 percent of the total hydro-electric energy available for sale and 66.0 percent of the total energy available for sale. At the end of the fiscal year, the Arkansas Power & Light Company was entitled to 217.7 million kilowatt-hours under the aluminum contract, the purchase and delivery of which were deferred in previous years, and the delivery of energy purchased by the Oklahoma utility companies, still deferred, amounted to only 0.7 million kilowatt-hours.

The Arkansas Power & Light Company received into its system under the Blakely Mountain contract 219.3 million kilowatt-hours. The Government withdrew 118.6 million kilowatt-hours, or 100.7 million kilowatt-hours less, from the Arkansas Power & Light system for delivery to other customers.

Revenues from sales by Southwestern Power Administration during the fiscal year billing periods amounted to $8,771,949. This amount includes sales to preference customers of $6,755,163, and sales to private utility companies of $2,016,786.

By the end of the fiscal year, wholesale power and energy generated by the hydroelectric facilities under the marketing jurisdiction of Southwestern Power Administration were being sold to 16 distribution cooperatives, 22 municipalities, 5 private utilities, 5 military installations, and 7 generating and transmission cooperatives.

Power and energy deliveries to preference customers in addition to being made directly over Southwestern Power Administration lines, were made through the facilities of the Texas Power & Light Co., the Southwestern Gas & Electric Co., the Public Service Company of Oklahoma, the Oklahoma Gas & Electric Co., the Central Electric Power Cooperative, the Western Farmers Electric Cooperative, the M. & A. Electric Power Cooperative, the N. W. Electric Power Cooperative, and the KAMO Electric Cooperative.

CONTRACTING

Contract negotiations which were initiated in fiscal year 1956 with five generating and transmission cooperatives were completed in fiscal year 1957. The negotiations with four of these cooperatives resulted in amendments to existing lease and power sales agreements, primarily to delete the Government's option to purchase the G. & T. transmission systems, to include provisions for the settlement of accounts on a net-balance basis, and the addition of provisions for operation and maintenance of the cooperatives' transmission systems by the cooperatives. Negotiations with the Sho-Me Power Corporation of Marshfield, Mo., the fifth of the five G. & T. cooperatives with which negotiations were initiated in fiscal year 1956, resulted in a new temporary agreement being executed to cover the period July 1, 1957, through June 30, 1962.

In addition to the amendments to the G. & T. contracts, new contracts have been executed between Southwestern Power Administration and the Central Electric Power Cooperative, and the Western Farmers Electric Cooperative. These new contracts, which have an effective date of July 1, 1957, supersede and make inoperative the existing lease contract with Central, and both the lease and power contracts with Western.

Major amendments were made to the contracts with the Texas Power & Light Co., and jointly with the Oklahoma Gas & Electric Co., and the Public Service Company of Oklahoma, and an additional contract was entered into with the Southwestern Gas & Electric Co.

Contracts with two additional preference customers, the city of Bentonville, Ark., and the city of Fulton, Mo., were executed during the year. Service to Fulton commenced on May 14, 1957, and service to Bentonville will begin when necessary interconnection is completed.

Contracts for the sale of dump power were executed with several preference customers.

During the year, contract demands and contract obligations were decreased by 11,345 kilowatts. Contracts were also amended to provide for 90 additional points of delivery and to abandon 29 delivery points.

At the end of fiscal year 1957, the sum of the power commitments to all preference customers served by Southwestern Power Administration amounted to 280,195 kilowatts, and were composed of the following:

	Kilowatts
Rural Electric Distribution Cooperatives	38, 055
G. & T. cooperatives	198, 800
Military installations	9, 900
Municipalities	33, 410

RATES

During the fiscal year, a repayment and average rate determination study was made, based on Corps of Engineers' 1955 and 1956 cost allocation reports. As a result, four rate schedules were proposed, which include Rate Schedule F–1, a rate schedule for firm power; Rate Schedule P–1, a rate schedule for peaking power; Rate Schedule I–C, a rate schedule for interruptible capacity; and Rate Schedule EE, a rate schedule for excess energy. The new rate schedules were submitted to the Federal Power Commission for confirmation and approval; however, approval had not been received at the end of the fiscal year. Confirmation and approval are expected early in fiscal year 1958.

FEDERAL CIVIL DEFENSE ACTIVITIES

At the request of the departmental defense liaison officer for FCDA Region No. 5, Southwestern Power Administration personnel was appointed to membership on the subcommittees of Training and Office Services. These committees were set up on a continuing basis for the purpose of studying the needs in these areas and recommending remedial action to the Regional FCDA Operating Board.

In response to a call from the local Civil Defense headquarters, 30 Southwestern Power Administration employees volunteered their help in evacuating a large section of Tulsa and in sandbagging the banks of the Arkansas River to avoid further inundation during the 1957 spring flood.

As a result of voluntary services in support of the air defense of the United States by employees of Southwestern Power Administration, the Ground Observer Corps, Air Defense Command, presented its Certificate of Recognition to this Administration at a Public Affairs Forum luncheon in the Tulsa Chamber of Commerce dining room on March 14, 1957.

The Interconnected Systems, Southwest Area, have, through their operating committee, set up procedures which provide for aid and assistance among the companies during disasters or other emergencies for the use of manpower, equipment, and material for restoration of service in the area.

FCDA Delegation No. 4 delegated to the Secretary of the Interior the responsibility to:

> Plan a national program, provide technical guidance to the States and direct Federal activities concerned with the emergency restoration of electric utility service to attacked areas and provision of adequate electric utility service to support areas.

This Administration as participant of the Interconnected Systems, Southwest Area, is governed in matters of electric power in civil defense activities by the acting executive director of the Southwest Power Pool who has been appointed to administer the authority under FCDA Delegation No. 4 for Interior Electric Power Area No. 12. In this connection, Southwestern Power Administration furnished personnel for the FCDA 1956 alert to assist the acting executive director of the Southwest Power Pool.

SOUTHWEST FIELD COMMITTEE

Representation on the Southwest Field Committee during fiscal year 1957 included active participation in programs and problems regarding water compacts, watershed planning under Public Law 566, new and pending legislation, preparation of the regional program report and civil defense activities.

The changing water situation in the Southwest has resulted in an adjustment of long-range programs to recognize present conditions and to expedite the consideration of water and power projects required to satisfy the most pressing needs.

We are cooperating in the Committee's program to meet the Department's obligation to keep the planning of water resource developments abreast of other developments in the region.

ARKANSAS-WHITE-RED BASINS INTERAGENCY COMMITTEE

Southwestern Power Administration has continued to participate in all meetings of the Arkansas-White-Red River Basins Interagency Committee during the fiscal year 1957.

With the Department of Agriculture as the chairman agency for fiscal year 1958, this Administration has expressed its interest to the incoming chairman, of our future participation and cooperation with this group in its program to provide, at the regional level, improvement of coordination of activities in the field of water and related land resources; providing means by which interagency problems in the field may be resolved; suggesting to the Interagency Committee on Water Resources and the States, changes in law or policy which would promote these purposes; and collecting and interpreting basic data.

SOUTHEASTERN POWER ADMINISTRATION

Chas. W. Leavy, *Administrator*

THE HYDROELECTRIC output marketed by the Southeastern Power Administration in fiscal year 1957 consisted of 988,000 kilowatts of capacity (with peak generation of 1,202,050 kilowatts) and 2,545,830,184 kilowatt-hours of energy. It was sold to 45 public bodies, 58 rural electric cooperatives, 1 Federal agency, and 6 privately owned utilities. The sales earned $13,644,211.77, an increase of $2,199,653.44 over earnings of the previous year, and brought revenues earned in all years to a total of $56,816,472.73.

The output was generated at ten Corps of Engineers projects. They were the Wolf Creek, Dale Hollow, Center Hill, and Old Hickory projects in Kentucky and Tennessee, the Allatoona and Buford projects in Georgia, the Clark Hill project in Georgia and South Carolina, the Jim Woodruff project in Florida, the John H. Kerr project in Virginia, and the Philpott project in Virginia. The installed generating capacity of 1,031,000 kilowatts at the beginning of the fiscal year was increased to 1,126,000 kilowatts during the year by installations at the Old Hickory, Buford and Jim Woodruff projects. Installation of additional generating units by the Corps of Engineers continued at the Old Hickory and Buford projects and construction by the Corps continued on three other projects (Cheatham in Tennessee, Fort Gaines in Georgia and Alabama and Hartwell in Georgia and South Carolina). The installations and construction under way will add 485,000 kilowatts of installed capacity.

The combined output of Wolf Creek, Center Hill, and Dale Hollow projects was sold to the Tennessee Valley Authority under a long-term contract and the output of the one unit installed at the Old Hickory project was sold to the Authority under a short-term, interim agreement. All power generated at the Allatoona project was sold under a long-term contract to the Georgia Power Co. All of the Philpott project output was sold to Appalachian Electric Power Co. under temporary arrangements pending the conclusion of negotiations for long-term sales. Part of the Clark Hill project output was sold under long-term contracts to two public bodies in South Carolina, and the one-half of the output of the Clark Hill project to be marketed in Georgia was sold under long-term contracts to Georgia Power Co. and 77 public bodies and cooperatives in Georgia. Two-thirds of the Kerr project's output was sold under long-term contracts to the Virginia Electric & Power Co., and to 17 cooperatives in Virginia and North Carolina and the remainder was sold under long-term contracts to Carolina Power & Light Co. and 16 public bodies and cooperatives in North Carolina.

The Congress appropriated $256,000 for headquarters operation and maintenance, and $1,669,000 for the purchase of firming energy and the payment of wheeling fees. Southeastern's working force numbered 34 employees at the beginning of the fiscal year and 35 employees when the year ended.

DEFENSE ELECTRIC POWER FUNCTIONS

ACTIVITIES in the defense electric power field are concerned with planning to assure an adequate power supply for the Nation under mobilization conditions. The Assistant Secretary—Water and Power Development—exercises direct supervision over these activities. The administration of electric power functions is vested in the Secretary of the Interior under the Defense Production Act, Executive orders, and delegations from the Office of Defense Mobilization and the Federal Civil Defense Administration.

In carrying out the present electric power delegations of the Office of Defense Mobilization and the Federal Civil Defense Administration, Interior is establishing field organizations in sixteen power areas throughout the Nation to cooperate with ODM and FCDA in assuring an adequate supply of electric power to essential services in the event of a national emergency.

A group composed of representatives from ODM, Departments of Commerce, Defense, and Interior, and the Federal Power Commission has completed a study evaluating the power situation in the Niagara area in the event of an enemy attack. This same group is now proceeding with a similar study of the Pacific Northwest.

A departmental representative served on a task group which reviewed and revised under new criteria the Industrial Evaluation Board analysis of electric power generating stations and substations throughout the entire United States.

Evaluation of data as to the production capacity of the electric power industry reveals little change in the scheduled rate of increase of generating capability in the United States from that of a year previous.

December peak capability, peak loads, and gross reserves as actually occurred in 1955 and 1956, and as forecast for 1957 through 1960, on the basis of median hydro conditions, are shown for the country as a whole.

Year	December capabilities (millions of kilowatts)	December peak loads (millions of kilowatts)	Gross reserves (percent of loads)
1955 actual	116. 1	97. 9	18. 6
1956 actual	122. 6	102. 4	19. 7
1957 estimated	131. 0	113. 4	15. 5
1958 estimated	148. 0	123. 1	20. 2
1959 estimated	160. 7	132. 2	21. 5
1960 estimated	171. 4	141. 5	21. 1

Although, in general, gross reserves are adequate on a national basis and are estimated to increase annually from 1957 through 1960, reserves are estimated to fall below 15 percent in Federal Power Commission Regions I in 1957 and 1958; II in 1957; III in 1957, 1959, and 1960; and VII in 1957 through 1960.

Under median hydro conditions it is estimated power will be available in all regions to supply all load requirements. Under adverse hydro conditions these same conditions prevail except in Region VII, the Pacific Northwest, where power to interruptible loads might have to be curtailed.

The Office of the Assistant Secretary—Water and Power Development—has been the allotting agency for a program which provided allotments and priority asistance on materials and equipment for construction of certain facilities including 89 generating units with nameplate ratings totaling 10,721,000 kilowatts to furnish interim, firm, and backup power to Atomic Energy Commission installations. The program which started in 1953, has been completed with the last unit going into service June 27, 1957.

Expansion Goals No. 55 (electric power) and No. 225 (power facilities for military, atomic energy, and defense related needs) have been closed. Under these two goals certificates of necessity for rapid tax amortization issued by ODM are related to an increase in the Nation's electric power capacity of approximately 35.5 million kilowatts.

OFFICE OF SALINE WATER

David S. Jenkins, *Director*

AMONG ALL OF THE natural resources, water is perhaps the most essential to human life and economic activity. As with other resources, potable water is not distributed equally among the various areas of our country. Consumption of water, like that of various other resources, has increased out of proportion to the increase in our population and some areas in this country are reaching the limit of their fresh water supplies. Because of the increasing demand for fresh water, our effective fresh water base is being reduced in a number of areas, by salt water intrusion into fresh water supplies by salt accumulation due to reuse and other causes, and by a lowering of the water table due to excessive withdrawals.

The saline water conversion program in seeking one answer to the growing problem of adequate water supplies, works toward the development of this vital natural resource. Very significant supplies of brackish underground and surface water exist in inland areas and an inexhaustible supply of ocean water is available at our shores. Thus, this Nation's water resource base can be developed and extended through saline water conversion.

Recognizing the needs and potential benefits to be gained from large scale purification of saline waters, the Congress of the United States authorized a research and development program directed toward the development of economically feasible processes for producing fresh water from sea and brackish waters, by enactment of Public Laws 448 (1952) and 111 (1955).

Progress toward the solution of this problem is being made and several desalinization processes under investigation look promising. Investigations in the field of distillation have been continued during the past 12 months and two different prototypes involving vapor compression and multiple-effect distillation, will be field-tested on live sea water during fiscal year 1958. Fabrication of the Badger-Hickman vapor compression unit having design capacity of 25,000 gallons per day has been completed and the unit has been shop-tested. The distillation cycle proposed by Mr. W. L. Badger utilizes long tube vertical evaporators in a multiple-effect distillation. The economy of this process, among other things, depends upon scale-free operation and a test unit is being assembled by Mr. Badger and the Whiting Corp. It will be tested on sea water for the purpose of developing scale prevention techniques. An engineering design study of a process involving low temperature vacuum flash distillation, often referred to as the low thermal difference system, is being made by the Griscom-Russell Co. A preliminary cost analysis study of certain nuclear power reactors and distillation equipment is being conducted by Fluor Corp. This investigation is being closely coordinated with the Atomic Energy Commission which is assisting in the development of the technical scope of the study.

Solar distillation requires a successful solution to the construction and maintenance costs of characteristically extensive solar distillation units, in contrast to thermal distillation where a more critical factor is the design of equipment to minimize energy costs. Research has continued during the year aimed at reducing construction costs of solar stills, improving materials and increasing production through a multiple-effect cycle and other means.

Research investigations have demonstrated that demineralization of saline waters is possible by several processes utilizing membranes. These processes consist of electrodialysis, reverse osmosis, osmionics, and transport depletion. One of the limiting factors in the use of these processes has been the membranes themselves. Consequently, research aimed at improving certain characteristics of the membranes was continued during the past year by the National Bureau of Standards, Polytechnic Institute of Brooklyn, and the University of Florida. Several industrial companies in the United States have developed improved ion-permeable membranes and their researches are continuing.

Membrane durability tests on an Ionics, Inc., demineralizer are being conducted at the Bureau of Reclamation Laboratories in Denver, Colo., and in addition a membrane evaluation program is underway at this facility. Informal cooperation with the Central Technical Institute (T. N. O.), The Hague, Netherlands, on electrodialysis was continued and the possibility of obtaining an experimental T. N. O. unit for testing in the Reclamation Laboratories is being explored.

An exploratory investigation at the University of Florida on the mechanism of water and ion flow through osmotic membranes was completed during the past year. The information obtained will materially assist the development of improved osmotic membranes for use in the reverse osmosis desalinization process.

The design, construction, and testing of a practical osmionic unit (an osmotically powered process developed by Dr. G. W. Murphy) was continued at Southern Research Institute. A small model designed to demineralize brackish water at the rate of 240 gallons per day will be tested toward the latter part of 1957.

Several investigations in the field of freezing were carried on. The Applied Science Laboratories continued their studies on ice crystal formation and the investigation being conducted by Battelle Memorial Institute on zone purification was extended. This latter study has progressed to the point where an engineering design study and an estimate of the potential economic feasibility of the process can soon be made. The investigation of a potentially promising process involving freezing by self-evaporation was undertaken by the Carrier Corp. Rapid progress is being made in the development of this process and preliminary cost analyses show that the process is economically promising, and a laboratory experimental unit is in operation.

The investigation of a solvent extraction process was continued by Texas A. & M. Research Foundation and an exploratory survey on the possibility of utilizing the principle of kidney function in the demineralization of saline water was initiated by Resources Research.

Plans for the first comprehensive Saline Water Conversion Symposium to be held in Washington, D. C., late in 1957, were well advanced, the details of which were handled by the National Academy of Sciences.

During the coming year field-testing of three prototype distillation units will be initiated and both fundamental and applied research on the problem will be continued.

Office of the Assistant Secretary
Mineral Resources

Felix Edgar Wormser, *Assistant Secretary*

THE ASSISTANT SECRETARY for Mineral Resources discharges the responsibilities of the Secretary of the Interior with respect to the Department's programs in the field of the development and utilization of minerals and metals, including mineral fuels. He exercises supervision over the Geological Survey, the Bureau of Mines, the Defense Minerals Exploration Administration, the Office of Oil and Gas, the Office of Minerals Mobilization, and the Division of Geography.

The Assistant Secretary serves as the principal spokesman for the Department of the Interior in the field of mineral affairs at the policymaking level within the Federal Government. He participates in meetings of the Council on Foreign Economics Policy as the Department's liaison representative, and sits frequently with the Defense Mobilization Board as problems involving minerals and fuels are considered. He is the Department's representative on the Titanium Advisory Committee.

The office coordinates the Department's representation on the interdepartmental advisory committees that the Department of Commerce utilizes in carrying out its responsibilities under the Export Control Act of 1949. Items in short supply requiring particular attention included iron and steel scrap, copper, nickel, and selenium. Substantial progress was made during the year toward relaxation, and where possible elimination of export controls.

In addition to the foregoing responsibilities, the Office of the Assistant Secretary, Mineral Resources, is the principal point of contact between the Federal Government and the mineral industries. The Assistant Secretary met frequently with representatives of the industry.

In connection with his responsibilities under the voluntary agreement relating to foreign petroleum supply, the Assistant Secretary for Mineral Resources supervised the development and implementation of the plan of action during the Suez crisis. Under the plan, domestic companies cooperatively took steps necessary to prevent, eliminate, or alleviate petroleum shortages which would otherwise have resulted from the interruptions in Middle East petroleum movements subsequent to the closing of the Suez Canal. The Assistant Secretary was active in the establishment of the Middle East Emergency Committee and attended meetings of that Committee. In appearances before congressional committees he reviewed the actions taken by the Middle East Emergency Committee and its associated foreign committees in implementing the "Oil Lift" to Europe.

The Office of the Assistant Secretary, Mineral Resources, completed work during the fiscal year on the development of proposals for a long-range minerals program. On June 4, 1957, Secretary Fred A. Seaton presented the program to the Congress. The program contained recommendations calling for the intensification and acceleration on the part of the Bureau of Mines and the Geological Survey of research and of those activities which must precede mining. It recommended that continued attention be given to the tax laws and to the laws governing mining and mineral leasing on the public lands. It proposed a program of financial assistance to exploration and called for special assistance to particular segments of the mining industry. Legislative proposals were submitted which, if passed, will place in effect important portions of the program.

The office aided in the preparation of testimony in connection with hearings on the long-range minerals program and on special legislation relating to lead and zinc.

The Office of the Assistant Secretary continued to supply information and advice to the Director of the Office of Defense Mobilization concerning the administration of the Government's long-range strategic stockpiling program. The Office also worked closely with the Office of Defense Mobilization and the Department of Agriculture regarding the acquisition of strategic and critical materials for the supplemental stockpile by barter. The Office was primarily responsible for the administration of the Domestic Tungsten, Asbestos, Fluorspar, and Columbium-Tantalum Production and Purchase Act of 1956 (Public Law 733, 84th Cong.). Funds allocated for purchases of tungsten and asbestos were exhausted prior to the end of the fiscal year. The Office participated extensively in the development of requests for additional appropriations to carry out the terms of Public Law 733 with respect to these commodities. Adequate funds were available for purchase of fluorspar and columbium-tantalum.

The Office continued to participate in the Department's program of post-attack planning. Staff members from the Office were active in planning and implementation of Operation Alert, 1956.

The Office also initiated and coordinated studies and analyses of tariffs on several minerals and metals as a basis for developing the Department's position with respect to proposed tariff legislation, and reviewed proposals for legislation dealing with minerals. The Office was responsible for preparation and presentation of testimony before congressional committees.

A detailed review of the helium supply and requirement situation was initiated in cooperation with defense agencies—the principal consumers of this commodity.

GEOLOGICAL SURVEY

Thomas B. Nolan, *Director*

THERE HAVE BEEN no changes during the past fiscal year in the primary responsibilities and duties of the Geological Survey—to determine the geologic conditions and appraise the Nation's mineral resource potential; to classify the public lands and supervise oil, gas, and mineral leases on the public lands; to map the surface features of the Nation; and to evaluate the availability and quality of United States water supplies. But some changes have been made in the Survey's organizational makeup and the tools with which it seeks to accomplish its assigned mission.

Reorganization of the Water Resources Division has been accomplished to serve the public better at a time when increasing workloads have stretched capacity to the limit. The revised structure is designed to improve program planning and to provide well-integrated operations within the division, and to improve facilities for increasingly important general hydrologic studies.

In topographic mapping, fieldmen made increased use of helicopters for transportation to remote or high areas. New higher powered helicopters enabled safe operations on 17 peaks more than 12,000 feet high, including Mount Whitney and Mount Rainier.

Under the guidance of mathematicians and earth scientists a modern electronic computer has simplified and speeded up several important administrative and scientific tasks including current payroll procedures, and has made it possible to accomplish in a matter of hours, research tasks in geology, water resources, and topography that formerly required the services of many technical persons working full time for weeks or months.

The following report summarizes technical and publications activities of the Survey during fiscal 1957, the 78th such report since the Bureau was established in 1879. It shows how Survey engineers and scientists have shared in promoting continued national economic security.

GEOLOGIC DIVISION

During fiscal year 1957 the Geologic Division continued its study of the geology of the United States and of the mineral resources of the Nation.

Survey geologists continued to provide technical data and evaluation in the programs of the Defense Minerals Exploration Administration, the Office of Minerals Mobilization, and the General Services Administration; geologic investigations of mineral resources in Latin America, Asia, and Africa were made for the International Cooperation Administration; a broad program of research in fissionable materials was continued for the Atomic Energy Commission; investigations of terrain conditions of selected areas were also continued for the Armed Forces; and, as in past years, Survey geologists served as advisers and consultants to the National Science Foundation, the Office of Defense Mobilization, and the Department of Defense. Many of the projects carried on by the Geological Survey are in cooperation with State agencies.

Mineral Deposits Investigations

Continued progress was made in mapping and appraising the Nation's mineral resources, and in obtaining and publishing data on the geologic setting of mineral deposits and the factors controlling their deposition and localization. Progress was made on the development of techniques useful in the search for additional deposits.

Fieldwork progressed on 67 projects, 35 others were in the report writing stage, and 15 were brought to completion. Laboratory support was accorded each, as appropriate, and in many of the field activities the geological investigations were supplemented by geophysical and geochemical work. Also, 24 laboratory research projects were active. Twenty-six of these projects were in cooperation with States. In addition, on behalf of the Atomic Energy Commission, 66 field projects were carried on, 21 of which were in the report writing stage. Another 39 projects involved laboratory research.

A total of 28 bulletins and professional papers and 34 maps were published in the regular Geological Survey series, 34 maps and explanatory texts were released through open files and large numbers of shorter contributions were made by release of data through State and journal publications.

More than 4,800 mineralogical determinations and some 280 rock analyses were made by the mineral and chemical laboratories, and literally thousands of special analyses involving spectrographic and X-ray diffraction techniques, plus some 230 mechanical analyses and

FIGURE 13.—Survey geologist selecting a rock sample for analysis; Jackson Hole, Wyo.

130 radiometric age determinations were made by the laboratories in support of the geologic mapping and other field activities.

Geochemical Exploration

During the year methods were developed by which the dispersal pattern of copper, mercury, and selenium may be traced in soils and rocks. A low-cost, compact, mobile, wet-chemical laboratory was constructed and equipped for the determination of 21 different elements. Studies in the ratio of oxygen-18 to oxygen-16 isotopes in hydrothermally altered rocks continued with promising results. It now seems fairly clear that variations in the isotopes of oxygen can be used to distinguish certain minerals formed by hydrothermal processes from the same minerals formed by marine sedimentary processes, and that the oxygen isotopic ratios in certain minerals formed under hydrothermal conditions vary with the distance from the conduits through which the heated solutions passed. These findings provide important new approaches to the search for mineral deposits.

Results of a study of the oxidized zinc ores of Colorado, Utah, Nevada, and California show that there are large reserves of low-grade oxidized ores in many places in these regions. A structural contour map of the Metaline lead-zinc district, Washington, was prepared and placed in open file. A report was published on Central Cochise County, Ariz., an area that includes a number of copper deposits. Results of the work show that the intrusive rocks in which the copper occurs are not of a common age.

Through the use of a curved X-ray spectrometer, methods were devised for the determination of thorium and uranium in zircon crystals to aid in the determination of the ratio of hafnium to zirconium in the crystal. By these methods it is now possible to detect as little as 5 micrograms of thorium. The curved X-ray spectrometer was designed by Survey scientists for use in detecting and analyzing very small crystals and minute quantities of mineral substances in the polished surfaces of some ores.

Work continued on resource studies of such commodities as niobium-tantalum, selenium, chromite, silica, titanium, graphite, potash, beryllium, magnesia, gypsum, manganese, platinum, tungsten and barite. Resource reports were published on fluorspar and gem stones of the United States. At the request of the Office of Minerals Mobilization, Survey commodity geologists participated in the preparation of detailed mineral materials surveys and summary reports on about seven commodities and a continuing review was maintained for a number of others.

Using two planes equipped for airborne geophysical work, the Geological Survey's DC–3 and a C–47 on loan from the Air Force, aeromagnetic or radioactivity surveys were made of large areas in the United States. Detailed aeromagnetic surveys were made in eastern Pennsylvania, northern Wisconsin, New Hampshire and Maine in cooperation with the respective States.

Gravity surveys were continued on the ground in western Colorado, eastern Utah, eastern California (Owens, Long, Panamint, and Death Valleys, and the Mojave desert) and the Cuyuna and Mesabi iron districts of Minnesota.

The Geological Survey's program on behalf of the Atomic Energy Commission is now oriented toward long-range, fundamental studies of the geologic processes that govern the emplacement of uranium deposits. These studies involve systematic geologic mapping and research with supporting geophysical and geochemical investigations to obtain data on the size, shape, and mineralogy of potential reserves and resources of radioactive materials.

In the Grants-Laguna area, New Mexico, detailed geologic work tends to confirm the concept of zoned ore deposits which, in this area, may save many feet of unnecessary exploratory drilling in the search for ore bodies. Studies in the Gas Hills-Hiland-Clarkson Hill area of Wyoming indicate that at least some of the uranium deposits are very young and are related to post-Miocene to Pleistocene tilting to the south. In the Texas coastal plain, airborne radioactivity and magnetic surveys in conjunction with geologic mapping have developed valuable data on the correlation of airborne radioactivity and geophysical data with the general geology of the area.

A program of systematic geologic mapping and minerals appraisal continued in cooperation with the Puerto Rico Economic Development Administration. Field mapping is nearly completed in six 7½-minute quadrangles and about half done on 3 others.

Mineral Fuels Investigations

The Geological Survey continued its program of mapping and research in potential oil- and gas-producing areas throughout the Nation to provide background information needed in the formulation of sound exploration programs. During fiscal year 1957 surface and subsurface geologic mapping, and stratigraphic investigations were conducted in 22 petroleum-producing or potentially producing States. In three States the work was done cooperatively with the State. A geophysical (gravity) map of the northwestern part of the Los Angeles basin, California, was completed and published. Study of a set of samples from a deep test well in southwestern Mississippi has indicated a structural uplift of considerable magnitude. This feature extends the off-shore oil possibilities eastward from Louisiana. A map of Nebraska showing test wells for oil and gas, anticlines and basins, oil and gas fields, pipelines, and the areal distribution of pre-Pennsylvanian rocks is being compiled for publication. Subsurface investigations were started in eastern Nebraska.

A folio of paleotectonic maps and charts was published showing the distribution, character, and variations in the strata of the Jurassic system of the United States. Work on a similar folio covering the Triassic system is near completion. These maps, which synthesize a vast amount of data that otherwise are widely scattered, represent a new departure in the presentation of stratigraphic data on a nation-wide scale. The initial volume has proved of especial interest to the oil industry.

Geologic investigations were carried on in eleven coal-producing states: Alabama, Arkansas, Colorado, Kentucky, Maryland, Montana, New Mexico, Pennsylvania, Tennessee, Utah, and Wyoming. Appraisals of coal reserves were continued in Alabama, Arkansas, Colorado, eastern Kentucky, and western Pennsylvania. Revision of the coal map of the United States is nearly complete.

A total of 7 bulletins and professional papers and 11 maps were published in fiscal year 1957 in the regular Geological Survey series, summarizing results of mineral fuels investigations. In addition, three reports were released through open file, and 26 reports were released through State and journal publications.

General Service Geology

A primary purpose of general service geology is to provide the geologic data needed in planning the construction of civil engineering works and the development of water and land utilization programs. Projects are designed, therefore, to yield geologic data on the distribution, character, and depth of foundation rock; on sources of construction materials; on feasibility of alternate routes of highways, aqueducts, or tunnels; on the suitability of terrain for airfields or other large installations; on the geologic aspects of soils; and on areas of potential landslides. Evaluations of these kinds are based on data gained from systematic geologic mapping and from research in geologic processes. Field work was carried forward on 43 projects, 8 of which were brought to completion; reports were being prepared on 13 others.

During the fiscal year 8 geologic quadrangle maps and accompanying reports, 3 miscellaneous geologic investigations maps, and 1 bulletin were published, 12 technical papers appeared in professional journals, and 12 reports were made available to the public in open-file depositories. Twelve geologic quadrangle maps, 4 professional papers, 1 bulletin, and 2 miscellaneous geologic investigations maps are in the process of preparation for publication by the Survey; 13 reports are being prepared for publication in technical journals.

Field work was completed at San Francisco, Calif., and a report on the results of the engineering geology study is near completion. Mapping progressed in the Seattle, Wash., Denver, Colo., and Los Angeles, Calif., areas. Reports on the Omaha, Nebr., and Portland, Oreg., areas were near completion.

Geologic mapping of both bedrock and surficial deposits continued in cooperation with the States of Massachusetts and Rhode Island, and the State of Connecticut, with emphasis on providing geologic background data needed in the solution of engineering problems. A mapping project in the upper Green River Valley, Utah, is near completion. Mapping continued along Lower Snake River, Wash., in the Great Falls region, Montana, and in the Upper South Platte, along the route of the Denver water diversion tunnel.

Studies of the landslides areas along the shoreline of Fort Randall, S. Dak., reservoir were completed. Studies were continued on seacliff erosion along the New England Coast. Laboratory tests were made of samples collected from critical parts of the areas mapped to provide information required by planning and design engineers on the physical character of the materials involved.

Work continued on the revision of the geologic maps of the States of Arizona and New Mexico. Work also continued on the preparation of a geologic map of the State of Oregon, and a preliminary map of the western part of the State was compiled for publication.

Alaskan Mineral Resources

A large portion of the overall effort during the year was devoted to preparation of reports on work previously done in Alaska. The Geological Survey published 9 bulletins and professional papers and 8 maps; 12 reports were released to open files; and 6 reports were printed by technical journals.

Reports were completed or nearing completion on high grade limestone deposits in the area of Hecata and Tuxekan Islands, southeastern Alaska; on reconnaissance investigations in the Glacier Bay area; on the large ilmenite-bearing layered basic intrusive body in the Fairweather Range; on reconnaissance examination of ilmenite-bearing beach sands near Lituya Bay; on the tin deposits of the Lost River mine; on the antimony deposits of the Stampede mine; and on the nickel deposits of the Funter Bay area. Photogeologic mapping at a scale of 1:250,000 was accomplished in the Iditarod, Talkeetna Mountains and Dixon Entrance quadrangles and in areas near Sitka and Juneau, Alaska, and Prince William Sound. Systematic geologic mapping was carried out in the Tofty-Eureka tin-gold placer district and in the vicinity of Nome. The first phase of a plan to test the application of hydrochemical and other geochemical prospecting techniques to Alaskan situations was started.

A general report on the geology of Alaska as related to petroleum possibilities was near completion. Compilation continued on the results of stratigraphic and structural studies of the Nelchina area and limited field studies were renewed. Oil and gas maps of the Yakataga and Malaspina districts of the Gulf of Alaska Tertiary Province were published. Progress was made toward completion of reports on Naval Petroleum Reserve No. 4 concerning investigations carried on in cooperation with the Navy during the period 1945–53. Field studies of the structural and stratigraphic characteristics of the Cretaceous rocks of the south-central part of Koyukuk Basin were completed and work on a report was started. These investigations are proving of considerable economic interest as much of this area has been leased for petroleum exploration.

Field investigation of Alaskan coal deposits were carried on in the Matanuska and Nenana coal fields. The work in the Matanuska area proved that the coal-bearing formation underlies a larger area than previously believed. Progress was made on a comprehensive report on the Nenana coal field and on a summary report on the coal resources of Alaska.

The engineering geology program in Alaska continued on a modest scale. Reports were prepared on surficial and engineering geology in the Nenana-Rex area, the Katalla area, the Susitna-Maclaren area and in small areas near Fairbanks.

National Minerals Policy

In accordance with the President's national minerals policy, several projects were started during the year that will contribute to a better understanding of the geochemical, geophysical, and geologic processes involved in the formation and localization of ore. Work was begun on the thermodynamic properties of ore and of rock-forming minerals, on the physical properties of earth materials, on the distribution of minor elements in intrusive rocks, on the environment and geochemistry of ore-forming solutions, and on the distribution of stable isotopes. Much of the effort this first year was spent in establishing laboratory facilities, testing procedures and calibrating instruments. In addition, research was begun on new and modified geophysical methods, on the use of color photography in photogeology and on hydrogeochemical prospecting.

In cooperation with the National Park Service, plans were completed and construction begun on a geochemical laboratory at the Hawaiian Volcano Observatory on the rim of Kilauea in Hawaii. The laboratory will provide facilities for making systematic studies of the geochemical aspects of the volcanic gases and other products, as a research project on chemical volcanology in the national minerals policy program.

Geologic mapping was started in 10 places in the United States and one in southeastern Alaska. Mapping effort was concentrated on geologically little known areas of Maine, Washington, and Alaska; on starting a geologic cross-section through the potential mineral-producing areas of the Southern Appalachians; and on detailed mapping in Montana to help us understand important geologic structures and their relation to the ore-bearing areas. Each of the mapping parties was given geochemical, geophysical, and paleontological support as required.

Military Geology

Geologic investigations on rock types, soil, vegetation and water resources were continued to provide technical advice to the Corps of Engineers, United States Army, and other agencies of the Armed Forces. During the year 42 comprehensive studies of foreign regions and 30 technical reports and maps were prepared by geologists, botanists, soil scientists, and other technicians in the Washington office. In addition, numerous advisory consultations, briefings, and lectures were provided to military personnel on the military aspects of the geology in foreign, territorial, and domestic areas.

Technical assistance to the Corps of Engineers in Germany and Japan was continued. A team of specialists (geologists and soil scientists) assigned to headquarters in Heidelberg directed and instructed military technicians in the preparation of special-purpose terrain maps.

Field studies during the year were continued in the western Pacific and Alaska. In the Pacific, field surveys were completed on the islands of Ishigaki and Miyako in the Ryukyu Islands. A soils survey was completed on Yap, Caroline Islands, and an investigation of the water resources was completed for Truk, Caroline Islands. Military geology reports for Palau and the northern Marshall Islands were published, and preparation for publication continued on reports for Truk, Okinawa, Tinian, Guam, Yap, Pagan, Ishigaki, and Miyako. The Engineer, United States Army Forces Far East, requested numerous engineering geology consultations, primarily on the evaluation and discovery of water resources for military use in Korea, Okinawa, and Taiwan. Aid was given to the Navy on problems encountered in the Marshall Islands.

The program of field surveys of geologic and associated terrain and permafrost conditions in Alaska continued for the eleventh year. Field reconnaissances were continued in the Copper River Basin. New projects were started in the areas of Johnson River and Thompson Pass. Comprehensive military and scientific reports were under way on 10 areas previously investigated. The Survey, in cooperation with the terrain and permafrost program of the Corps of Engineers, United States Army, and supplementing it, carried on geothermal studies in the vicinity of Glenallen in the Copper River Basin and in the Fort Greeley area. Geologic mapping was completed in the Mount Hoyes D–3 quadrangle. The compilation of a surficial deposits map of Alaska was begun and work continued on compilation of a glacial map of Alaska.

In addition to furnishing advice and studies to the Corps of Engineers, the Survey made field studies on problems in the Arctic, primarily Greenland, for the Air Force.

Foreign Geology

Technical assistance in geology and mineral resource investigations was extended to 17 countries in Latin America, Africa, Asia, and the Far East under the auspices of the International Cooperation Administration, United States Department of State. Cooperative minerals studies were continued with counterpart scientific agencies i Brazil, Chile, Peru, Mexico, India, Libya, China, Indonesia, and th Philippines. Cooperative studies were begun in Pakistan, Iran, an Thailand. Joint mineral studies were completed in Cuba, Israel and Egypt. Advisory services in geology were extended to the Governments of Ecuador and Costa Rica. Two specialists in geologica education began a 3-month study of facilities at the University o Chile toward the establishment of a new school of geology. Specialists in engineering geology and ore deposits completed 4-month seminars at the Geological Survey of India.

Thirty-two participants from 18 countries, under the sponsorshi of the International Cooperation Administration and the United Nations, received training in the Survey's domestic program.

Survey personnel were giving training to more than 100 national of countries in which long-term projects are being conducted. I addition, nationals of Afghanistan, Bolivia, India, Pakistan, Philippines, Spain, Taiwan, Thailand, and Turkey received training in the United States.

Library

The 1952–53, the 1954, and the 1940–49 cumulative volumes of the Bibliography of North American Geology have been published and the 1955 volume is in press.

Library use and activity in the Geological Survey Library in Washington and its branches in Denver and Menlo Park are summarized as follows:

Activity	Washington	Denver	Menlo Park
Text accessions	24, 256	20, 883	14, 594
Map accessions	2, 380	1, 519	3, 280
Loans to Survey personnel	44, 779	12, 455	3, 556
Loans to other libraries	6, 040	784	550
Items borrowed from other libraries	7, 391	1, 513	500
Items used within library	102, 105	42, 351	12, 948

WATER RESOURCES DIVISION

The Water Resources Division is responsible for determining, appraising, and describing surface and underground water resources and water problems of the Nation. The tremendous past and prospective growth of the Nation has sharpened the focus of attention on water problems of the whole country, as well as on local areas nd regions. The recurrence of disastrous floods and droughts has ncreased public awareness of the importance of water problems.

Water resources investigations include the systematic collection, nalysis, and publication of hydrologic and related geologic data; ppraisal of water resources of specific areas; determination of water equirements for industrial, domestic, and agricultural uses; and re-earch and development to improve techniques and the scientific basis f investigations.

Three sources of funds are available for financing water-resources nvestigations:

1. Direct appropriation.

2. Funds provided by States and municipalities to be matched by he Federal funds for investigations having mutual interest.

3. Funds transferred from other Federal agencies for work per-ormed at their request.

Federal-State cooperative investigations began in 1895 and this ype of program has grown steadily, now constituting about 60 per-ent of the Division's total program. Funds made available by States nd municipalities in 1957 for cooperative studies are shown in the ollowing table:

labama	$167, 800	Nevada	$31, 595
rizona	127, 414	New Hampshire	20, 881
rkansas	54, 079	New Jersey	132, 282
alifornia	430, 141	New Mexico	193, 296
olorado	111, 786	New York	263, 696
onnecticut	36, 600	North Carolina	123, 079
elaware	29, 662	North Dakota	36, 418
lorida	201, 362	Ohio	153, 051
uam	20, 090	Oklahoma	116, 527
awaii	107, 936	Oregon	70, 189
eorgia	104, 849	Pennsylvania	175, 174
daho	63, 026	Rhode Island	24, 742
linois	72, 637	Samoa	1, 738
ndiana	152, 585	South Carolina	36, 413
owa	60, 603	South Dakota	27, 569
ansas	91, 556	Tennessee	89, 827
entucky	144, 745	Texas	369, 883
ouisiana	166, 675	Utah	114, 909
aine	12, 594	Vermont	8, 560
aryland	61, 581	Virginia	70, 627
assachusetts	49, 582	Washington	129, 793
ichigan	92, 475	West Virginia	36, 220
innesota	126, 879	Wisconsin	50, 460
ississippi	61, 424	Wyoming	65, 736
issouri	40, 061		
ontana	57, 096	Total	5, 069, 515
ebraska	81, 972		

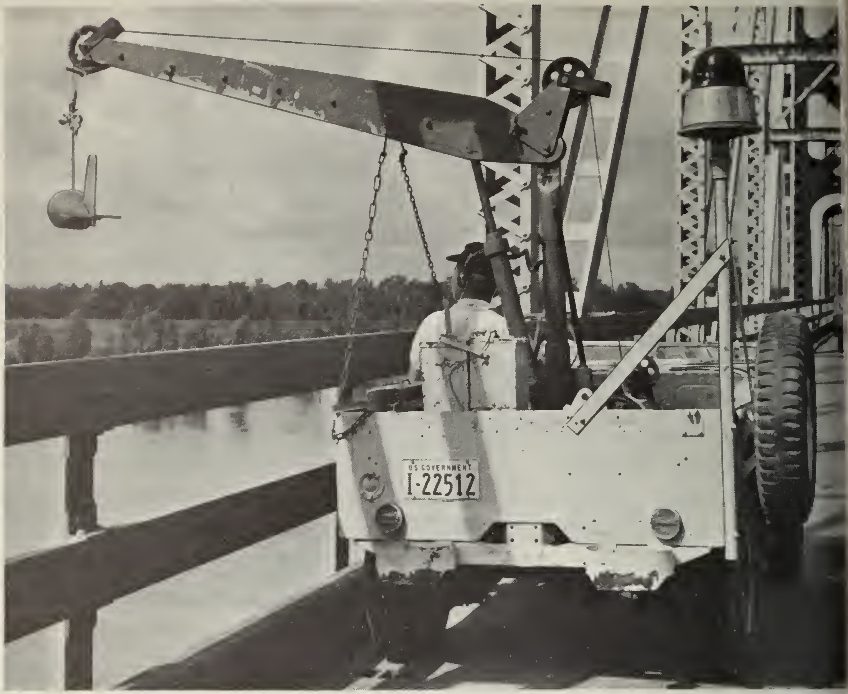


FIGURE 14.—Survey engineer lowers a current meter with 300-pound sounding weight attached, in the course of gathering streamflow data on the Atchafalaya River.

Surface Water Investigations

Surface-water records were obtained at 6,900 sites in the continental United States and in Alaska, Hawaii, and Guam during the fiscal year 1957. The records include 4,600 collected in cooperation with 195 agencies of States or their subdivisions, about 600 collected under the Federal program of the Water Resources Division and 1,700 obtained for other Federal agencies such as the Corps of Engineers, Bureau of Reclamation, Tennessee Valley Authority, State Department, Soil Conservation Service, Atomic Energy Commission, and permittees and licensees of the Federal Power Commission.

Compilation of all streamflow records in the United States for the period 1888–1950, a project which was started in 1951, is now 77 percent complete. During the year the compilation volume for the Snake River basin was published. Formerly this type of historical and long-term streamflow data was scattered in nearly 50 volumes of the annual report series of water-supply papers.

Flood-frequency analyses for Florida, North Dakota, and South Dakota, conducted cooperatively by the Geological Survey and those States, were completed and are being prepared for publication. Regional flood-frequency analyses for the Colorado River basin, part of a nationwide flood-frequency study, were well advanced during he year.

New cooperative programs with several State highway departments vere begun, and several existing programs were enlarged. Hydraulic data on about 90 bridge sites were furnished to highway departments. The program of collecting flood-flow data on small streams, by means of crest-stage gages or by establishment of gaging stations, vas enlarged.

The manuscripts for two flood reports were transmitted to the printer, and the manuscripts for three others were being prepared or publication. Reports on the floods of August–October 1955, New England to North Carolina, and the floods of December 1955–January 956 in the far Western States were in an advanced stage of preparaion at the end of the year.

Rainfall-runoff analyses of maximum annual floods were made for bout 825 gaging stations in the United States, including all gaging tations that record runoff from drainage areas of less than 400 square miles. The work was done with transferred funds on behalf of the Soil Conservation Service.

The first phases of a review of the nationwide stream-gaging network was completed during the year. In the review, all streamgaging stations were classified as being either (1) hydrologic network or (2) water management. The hydrologic network provides basic lata for hydrologic studies. Water management stations are operted to provide information where needed for specific purposes. The results of this review will be appraised for uniformity and dapted for use in planning the program of collecting basic surfacevater data.

Interstate compacts for the apportionment of interstate waters usully include provisions for the measurement of streamflow, commonly y the Geological Survey. Sixteen such compacts are now in effect nd seven others are under negotiation. Water resources investigaons were made along the Canadian boundary, as required by the Boundary Waters Treaty of January 11, 1909, between the United tates and Canada, or by order of the International Joint Commission.

Ground Water Investigations

The greater part of the effort in ground-water studies was applied o areal investigations and reports on the geology and ground-water resources of geographic or hydrologic units—commonly of counties or ground-water basins—thereby contributing to the objective of ultimate nationwide coverage. The activities, however, ranged from research on the principles of occurrence and movement of water in various geologic and hydrologic environments, through the areal investigations, to systematic, continuing inventories of draft, and observatons of water-level fluctuations. Research, besides adding directly to knowledge of hydrogeologic processes, provides increasingly effective techniques for the analysis of areal problems and the interpretation and reporting of the results of analyses. The continuing inventories provide records of operating experience in the ground-water reservoirs.

About 575 ground-water investigations were in progress or were completed during the year. Four-fifths of these were in financial cooperation with State and local public agencies in 44 States and the Territories of Hawaii and Guam. About one-fifth preponderantly of national interest or of direct concern to other Federal agencies, were financed wholly from Federal sources.

Results of investigations were made available to the public in 123 published reports and papers and in 146 reports released to the open file. The published reports include 22 water-supply papers, 2 hydrologic atlases, 5 circulars, 37 reports published by cooperating agencies, and 30 papers in scientific journals. About 30 additional reports were released for administrative use by Federal agencies.

Adequate supplies of ground water of good quality for most private, industrial, and municipal needs are described in many reports covering counties, quadrangles, and other subdivisions of States from Rhode Island to California. Other reports, however, show that some areas have less plentiful supplies or supplies of poor chemical quality. For example, in some coastal areas full development of apparently ample supplies of ground water is hampered wherever subsurface conditions permit sea water to move inland when the hydraulic head of the fresh water is lowered by heavy pumping.

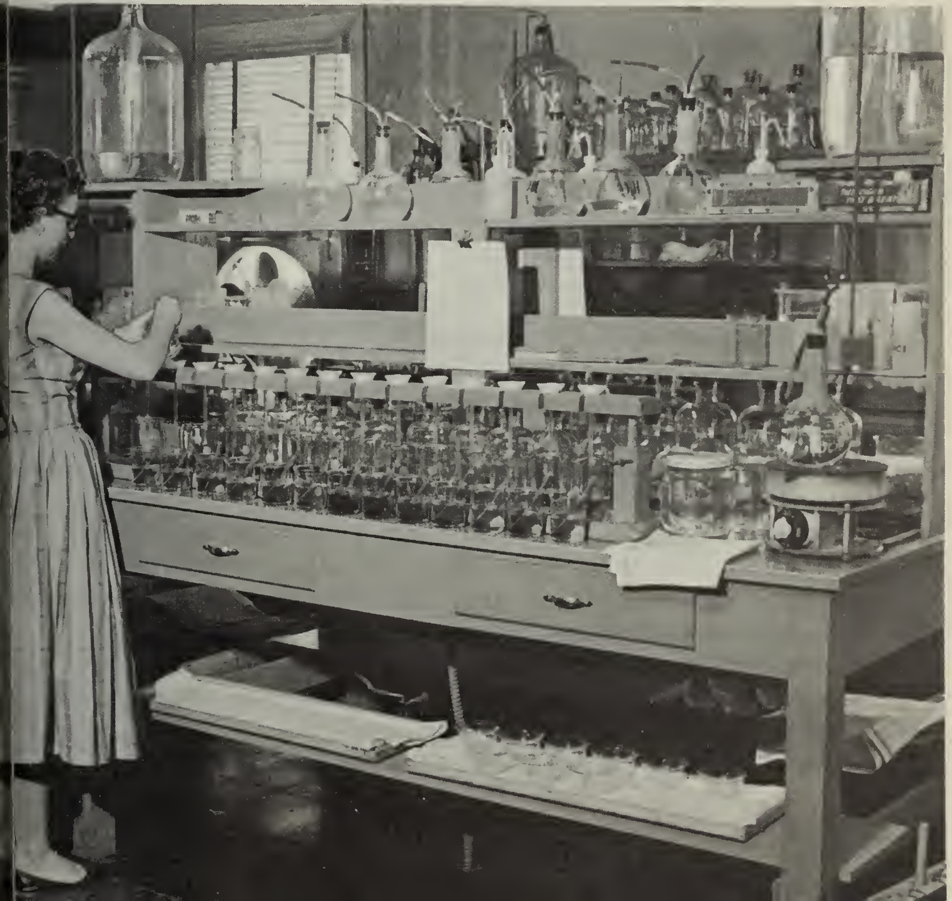
Considerable attention is being given to the use and expansion of natural underground storage facilities, which can be made to complement surface reservoirs in water management. Artificial recharge studies near Amarillo, Tex., show that 10,000 acre-feet or more of water could be stored in the Ogallala formation beneath a square mile of land that contains the municipal McDonald well field. Studies in the San Joaquin Valley of California indicate that the gross ground-water storage capacity in the depth interval between 10 and 200 feet below the land surface in an area of 10,000 square miles is about 90 million acre-feet. In 1955 the quantity of ground water pumped for irrigation in this area was about 9 million acre-feet, or about twoirds of the total withdrawal of ground water for irrigation in all of alifornia and at least a fourth of the total in the entire United tates.

A report on the springs in the Snake River Valley in Idaho inudes records for the period 1899–1947 and provides an invaluable asis for future measurement and investigation of the effects of water evelopment and of the total water yield of the upper Snake River asin.

hemical Quality of Water Investigation

Investigations of the quantity, type, source, and distribution of ineral matter in solution in natural waters were continued in 1957. uring 1957 the chemical quality of about 60,000 samples of water om streams, lakes, springs, and wells was determined. Most of the mples were daily and periodic samples from about 500 sites, mostly streams; about 7,500 analyses were of ground water. The nation-

FIGURE 15.—Survey chemist studies dissolved materials occurring in natural water.



wide program included operation of a network of sampling statio on 75 streams west of the Mississippi River to determine trends mineral content and thus help to ensure successful continued oper tion of irrigation projects.

Important advances were made in the programing of quality-o water studies on streams through the development of criteria f station network operation to satisfy minimum national needs.

In addition to the nationwide program, more intensive chemica quality investigations were in progress in the basins of the Colora River, Missouri River, Pecos River, and Columbia River, in the Ne York-New England States, and in Alaska. Chemical-quality studi of surface and ground waters were conducted in cooperation wi State and municipal agencies in 16 States. Special chemical-quali studies were made also for the Department of Defense, Atomic Energ Commission, Bureau of Reclamation, Veterans Administration, Fe eral Housing Authority, and Public Health Service.

Reports on chemical-quality studies of particular interest, pu lished or released during 1956, include those on an investigation water quality in the Fort Belvoir, Va., area, 1954–55, and on the qua ity of surface waters for irrigation in the Western United States i 1953; a detailed reference report was prepared on the study and inte pretation of the chemical characteristics of natural water; a repo was prepared on a study of the salinity of water in the Delawa River estuary. Reports describing the chemical characteristics surface waters of Virginia, Arkansas, Texas, New York, and Nort Carolina were prepared in cooperation with those States. Studie were begun on the uranium and radium content of ground water i several areas of the West.

Sediment Investigations

Investigations of the quantity, movement, and sources of wate borne sediments and their effects upon reservoir storage, navigabl waterways, diversion works, irrigation canals, and water-supply sys tems were continued in 1957. Measurements were made regularly o sediment movement at about 217 sampling sites. Comprehensive sedi ment studies were continued in the Missouri, Middle Rio Grande, an Colorado River basins. These programs provided measurements an interpretations of sources of sediment, rates of discharge, and othe pertinent facts at selected areas and locations to guide the extensiv Federal programs of water development in these areas.

Assistance to the program of the Soil Conservation Service wa provided by studies of sediment yields and trap efficiency of reser voirs in small watersheds in the States of North Carolina, West Virginia, Kentucky, Georgia, Nebraska, Oklahoma, and Texas. Specia

diment studies were made for the Bureau of Reclamation in the
io Grande and Colorado River basins and in the Medicine Creek,
ebr., watershed.

Cooperative programs which integrate Federal and State data re-
uirements in sedimentation were continued in Iowa, Wisconsin, Ken-
icky, Ohio, Pennsylvania, and Virginia. Included were intensive
ivestigations of several small watersheds in Pennsylvania and Wis-
onsin to measure and explain changes in the runoff and sediment dis-
iarge associated with changes of land use.

pecial Investigations

A comprehensive study of the hydrology and evaluation of the
ater resources of the Delaware River basin was started. Comple-
on of the project is scheduled for fiscal 1959. Accomplishments to
ate include an open-file report on water use in the basin and an ad-
inistrative report on sedimentation and ground-water resources of
e basin. A report on precipitation, runoff, and evaporation is being
repared in collaboration with the Weather Bureau.

In eastern Pennsylvania, Survey geologists have continued to act
geologic consultants in a program designed to conserve anthracite
al reserves through mine drainage. During the past year they have
rovided the Bureau of Mines with administrative reports on geo-
gic and hydrologic conditions affecting the feasibility of six pro-
osed surface drainage projects and seven proposed pump
stallations.

Preparation of comprehensive reports on the water resources of in-
istrial areas continued during 1957. Four reports of this series
ere published during the year covering Mobile, Ala., Portland,
reg., New Orleans, La., and the San Francisco Bay area, Calif.
eports on six other localities were in preparation.

Studies of the water requirements of specific industries were con-
nued. A report on the water requirements of the aluminum in-
istry was printed and a report on the rayon and acetate fiber
dustry was in press. Studies on water requirements of the copper
id petroleum industries were started. An inventory of water used
the United States during 1955 was completed and published as
. S. Geological Survey Circular 398.

il and Moisture Conservation

The Geological Survey continued to investigate the hydrologic and
ologic conditions on public lands to provide data needed by Interior
epartment agencies for the wise and efficient use and management
those lands. Investigations were made of water supplies in grazing

areas in Utah, Nevada, Idaho, and California. Data on runoff a sediment yields were collected for reservoirs constructed as part the conservation program on the public lands in Montana, Wyomin Colorado, Utah, New Mexico, and Arizona. A project was start in the Cheyenne River basin to evaluate the effect of water spreadi on water yield of the basin and on the movement of sediment.

Research and Development

Research is an essential part of the responsibilities of the Geologic Survey. This research seeks new discoveries in water science, ne ways of water measurements and utilization of the knowledge gaine

Some research in water science is aimed, for example, toward e plaining the principles governing the movement of water and e trained sediment through river channels. This information leads better understanding of the long-term effects of reservoir impoun ments, channel modifications, and climatic variations on channel er sion and sedimentation. Water shortages in the West have highlighte the need for research on the effects on runoff after the propose removal of upland vegetation, and of methods for suppressing evap ration from lakes and reservoirs. Advances or recessions of glacie are being studied in relation to long-term fluctuations in water su plies. Continued increases in flood damage intensify the need f accurate methods of estimating potential floods in areas where strea have not been gaged, for the development of hydrologic principl applicable to the zoning of urban lands subject to floods. Furthe progress in theoretical and field studies of the mechanics of groun water recharge have advanced understanding of the artificial recharg of depleted ground-water reservoirs.

Ultrasonic instruments for the measurement of water velocity a being tested. These instruments will make it possible for the firs time to obtain continuous measurements of water speeds.

Among the new projects for interpreting basic water facts is a analysis of the relative influence of climate and vegetation on meas ured sediment yields. Records of storage in reservoirs are bein studied to determine the amounts of water made available by presen development and to devise methods for defining optimum yield fro reservoir regulation.

Technical Assistance Program

Technical assistance program activities under auspices of the Inter national Cooperation Administration were continued during fisca year 1957 with long-term projects in progress in Afghanistan, Chile India, Iran, Libya, Pakistan, Philippines, Peru, and Saudi Arabia a e close of the year. Personnel were assigned for short periods to ritish Guiana, the Philippine Islands, and Turkey to assist in odernizing or expanding water-resources investigations.

Technical assistance continued to emphasize the establishment or rengthening of foreign governmental organizations engaged in ater-resources investigations. On-the-job training in investigational ethods and techniques and advisory assistance in organizational hases have been the principal means of assistance.

CONSERVATION DIVISION

The Conservation Division classifies Federal lands as to mineral and ater resource values and supervises mineral-recovery under leases, ermits, and licenses on Federal, Indian, and Naval petroleum reserve nds. A small headquarters staff and a field staff of competent geolo- ists and engineers are employed. This force makes field surveys, repares maps and reports dealing with waterpower, fuels, minerals, nd chemicals essential to the mineral-resource economy of the United tates, and supervises mining and drilling operations to assure the fe and economical production by private enterprise of coal, oil, gas, nd other minerals.

The supervisory activities of the Division contributed or were re- ponsible for $132 million income to the Government for distribution States, special funds, Indian lessors or the Federal Treasury.

Public land income is allotted 10 percent to the Federal Treasury, 7½ percent to the State from which produced (for schools and ads), and 52½ percent to the Reclamation Bureau for general use the Western States except that in Alaska 90 percent is paid to the erritory and 10 percent to the Federal Treasury. Acquired land come is distributed according to the laws applicable thereto. In- me from supervised operations on outer Continental Shelf, military, nd naval lands is deposited in the United States Treasury. All come from restricted Indian land is received for the benefit of the ibe or allottee.

ineral Classification

Geologists working from headquarters at Washington, D. C., and ld offices in Alaska, Colorado, California, Montana, New Mexico, klahoma, Utah, and Wyoming, make specific investigations that sult in geologic reports and maps primarily for use in the admin- tration of mineral leases, and the application of efficient methods of covery of the products involved. During the 1957 fiscal year maps nd reports were completed on a part of the Williams Fork coalfield, olorado; Twin Buttes gas field, Colorado; Ash Creek and West

Sussex (Dugout) oilfields, Wyoming; Danforth Hills and Maudli Gulch oilfields, Colorado; Glenrock project, Wyoming; and Nesso Anticline, North Dakota. In addition a mineral map of New Mexic was prepared. Classification standards for oil shale, phosphate, potash, and oil and gas are in process of revision.

A total of 32,926 cases were processed including 5,283 cases involving the outright disposal of Federal lands, either with no reservatio of minerals or with the reservation of one or more specified minerals and 27,643 cases involving the Government's right under Federal leasing laws to lease a mineral substance from lands under its jurisdiction. This was an increase of 4,042 over the number of similar cases for the previous year. In addition initial or revised definitions of 57 producing oil and gas fields containing Federal lands were promulgated; 262 unit-plan and participating-area proposals were appraised geologically; 57 determinations were made of the productive limits of producing oil and gas deposits as found to exist on August 8, 1946; the geologic significance of 182 new discoveries of oil or gas made on or affecting Federal-land leaseholds were reported for appropriate action; the competitive sale of oil and gas leases on 15 parcels of public land was recommended; 12 appeals from decisions of the Bureau of Land Management affecting the disposal of Federal lands were reviewed and reported; and 89 miscellaneous reports were prepared on the mineral potentialities of specific lands for various agencies of the Federal Government.

Water and Power

Investigations of streams and lakes on public lands to determine their waterpower and storage possibilities are carried out from a central office in Washington, D. C., and four field offices located in Denver, Colo.; Sacramento, Calif.; Portland, Oreg.; and Tacoma, Wash. Investigatory work in Alaska is supervised from the Tacoma office. Field work during 1957 was directed mainly toward obtaining basic information on the waterpower resources and storage possibilities of Federal lands in Alaska, California, Idaho, Montana, Oregon, and Washington. Field projects completed during the year or in progress on June 30 include surveys on Baranof and Carbon Lakes on Baranof Island, Chilkoot Lake near Haines, and Tanana River, Alaska; Kaweah, Kern, Klamath, and Stanislaus Rivers, California; Lemhi River, Idaho; Clarks Fork (of Columbia River) and Rock Creek, Montana; Imnaha and Deschutes Rivers, Oregon; Wind, White Salmon, and Klickitat Rivers, Washington.

The foregoing projects include 715 miles of stream-channel surveys and 16 dam site surveys. These projects normally extend over a 3-year period from start to map publication, and for the current year the work completed would be the equivalent of about 350 miles of channel surveys and 15 dam-site surveys.

Maps resulting from previous field work were, as of June 30, in various stages of preparation for publication for 260 miles of stream topography and 9 dam sites. Maps published during the year covered 110 miles of streams and 6 dam sites. Maps completed and in process of publication cover 250 miles of streams and 9 dam sites.

During the year one report was approved for publication as a circular, one report was placed in open file, and one report was approved for publication in a technical journal. In keeping with the program of making a systematic review of waterpower withdrawals, six reports were prepared which resulted in recommendations for the outright restoration of 40,000 acres and the restoration of 35,000 acres of previously withdrawn lands, under the provisions of section 24 of the Federal Power Act. Sixty-one reports relating to water resources by other agencies were reviewed in the Washington office.

Classification activities resulted in the addition of 28,873 acres in power-site reserves and the elimination of 28,935 acres. The outstanding reserves in 23 States and Alaska show a net total of 7,128,553 acres. The total reserves for reservoir site did not change and remain at 134,823 acres. Reports were prepared and submitted to the Bureau of Land Management on 415 cases involving the waterpower value of lands affected in applications for rights-of-way and 5,283 applications for land acquisition. One hundred and ten reports on cases affecting power site lands were prepared and submitted to the Federal Power Commission.

Mining Supervision

Supervisory operations were concerned with discovery, development, and production of coal, potassium, sodium, phosphate, and oil shale from public lands; of sulfur on public lands in Louisiana and New Mexico; of silica sand on certain lands in Nevada withdrawn by Executive Order No. 5105; of gold, silver, and mercury on certain Spanish land grants; of all minerals, except oil and gas, on restricted, allotted, and tribal Indian lands; on "acquired lands" under the act of August 7, 1947, and provisions of section 402 of the President's Reorganization Plan No. III of 1946; on land in the California State Park under the act of March 3, 1933 (47 Stat. 1487); and on National Forest land in Minnesota under the act of June 30, 1950 (64 Stat. 311). Outstanding mineral leases and permits on "acquired" and Indian lands and lands subject to the above-mentioned acts involve the exploration for and production of copper, gold, iron, lead, manganese, silver, nickel, titanium, tungsten, uranium, vanadium, zinc, asbestos, bentonite, clay, coal, garnet, gravel, gypsum, feldspar, fluorspar, limestone, mica, phosphate, pumice, quartzite, quartz crystal, sand, sili sand, sulfur, and vermiculite.

Mining supervision includes responsibility for investigation ar reporting on applications for leases and prospecting permits; recon mending lease terms enforcing compliance with lease terms and (regulations governing the conduct of prospecting, mining, and ben ficiation; protecting and conserving the natural resources by pr venting waste; determining royalty liability; preparing statemen and receiving payment of royalties and rentals. It also involves ac visory service to the Office of the Secretary, other bureaus of th Department, and other Government agencies.

As of June 30, 1957, there were under supervision 3,289 properti involved in leases, permits, and licenses in 32 States and Alaska, c which 1,920 were on public lands, 430 on acquired lands, and 939 o Indian lands. Annual production from such lands under supervisio during the fiscal year is estimated at 19,162,000 tons, valued at $143 736,000 with royalties amounting to $7,042,000. The production o coal from public domain land in the United States and Alaska aggre gated 5,531,000 tons, valued at $31,509,000 with a royalty value o $687,000. Production of coal in Alaska amounted to 739,000 tons Potash production amounted to 8,049,000 tons of crude and refine salts valued at $56,617,000 and royalty value of $2,233,000 during th fiscal year. The principal source of sodium was Searles Lake, Calif. accounting for 641,000 tons of the total of 881,000 tons of sodium an associated compounds produced from lands under supervision. Tota value and royalty value of sodium were $22,722,000 and $748,000 re spectively. Phosphate rock and shale production was 1,409,000 ton —990,000 tons from public domain valued at $1,904,000 with a royalty value of $200,000; 4,000 tons from acquired lands, and 415,000 tons from Indian lands. Production of lead and zinc concentrates from Indian lands amounted to 28,000 tons valued at $3,155,000 and royalty value of $246,000. The output of uranium and vanadium ores from Indian lands was 1,460,000 tons valued at $23,252,000 and royalty value of $2,724,000. Phosphate, coal, and sand and gravel made up the major part of the remainder of the production from Indian lands totaling 1,566,000 tons valued at $1,524,000 and royalty value of $125,000. Coal, fluorspar, zinc, asbestos, bentonite, phosphate, mica, manganese, quartzite, quartz crystal, stone, and sand and gravel were produced from acquired lands in 13 states to an aggregate of 658,000 tons valued at $3,047,000 and royalty value of $79,000.

Oil and Gas Supervision

Operations for the discovery, development, and production of crude oil, natural gas, and products extracted from natural gas are super-

GURE 16.—Offshore oil and gas activities on the outer Continental Shelf are under supervision of the Geological Survey, Department of the Interior.

sed on Federal, Indian, and certain naval petroleum reserve lands.
hese duties were carried out during the year through 6 area offices
d 21 district offices in California, Colorado, Louisiana, Montana,
ew Mexico, Oklahoma, Wyoming, and Washington, D. C.

On the public lands 106,279 oil and gas properties were under super-
sion at the end of the fiscal year, aggregating 77,071,099 acres in 24
ates and Alaska. Drilling on public lands during the year included
e spudding of 1,920 wells and the completion of 1,841 wells, of which
255 were productive of oil and gas. In all, 25,395 public-land wells,

including 14,663 capable of oil or gas production, were under supervision on June 30, 1957. Production was appreciably greater than in 1956, amounting to about 131,407,000 barrels of petroleum; 367,458,913,000 cubic feet of natural gas; and 216,938,000 gallons of gasoline and butane, with royalty returns to the Government of about $50,278,000.

There were 4,490 acquired land leases embracing 3,943,000 acres in 8 States under supervision at the end of the fiscal year. Drilling on acquired lands during the year included the spudding of 83 wells and the completion of 86 wells, 32 of which produced oil and gas. In all, 608 acquired-land wells, including 261 capable of oil and gas production, were under supervision on June 30. Including compensatory royalty allocated to the Rio Vista gas field the production from acquired land was about 6,182,000 barrels of petroleum; 15,598,489,000 cubic feet of natural gas; and 385,500 gallons of gasoline and butane, with royalty returns of about $2,822,000.

Operations were supervised on 11,265 leaseholds, embracing 3,574,796 acres on Indian lands in 19 States. Drilling on Indian lands during the year included the spudding of 722 wells and the completion of 723 wells, of which 487 produced oil and gas. In all, 9,308 Indian land wells, including 5,363 capable of oil and gas production, were under supervision on June 30. Revenues from rentals, royalties, and bonuses on Indian land amounted to about $55,086,000.

Drilling on military lands during the year included the spudding of 9 wells and the completion of 7 wells, 6 of which were productive of oil and gas. In all, 64 military land wells, including 57 capable of oil and gas production, were under supervision on June 30. Royalty on the production of oil, gas and liquid petroleum gases from military lands amounted to $2,387,000.

On behalf of the Department of the Navy, supervision was continued over operations for the production of oil, gas, gasoline, butane, and propane from 17 properties under lease in Naval Petroleum Reserve No. 2 in California. Production from 291 active wells totaled 2,413,000 barrels of petroleum; 6,138,763,000 cubic feet of natural gas, of which 2,870,005,000 were net sales, the remainder being gas injected for pressure maintenance, shrinkage from the extraction of liquid products, or fuel used on leases; and 10,195,000 gallons of natural gasoline with an aggregate royalty value of $1,129,000.

Work on the outer Continental Shelf involved supervision of 298 leases, originally issued by the States of Louisiana and Texas, and over which jurisdiction was assumed by the Federal Government under section 6 of the outer Continental Shelf Lands Act, and 235 leases issued under section 8 of that act, containing at the end of the year a total of 896 wells, 481 of which were productive of oil and gas. Drilling on the outer shelf involved the spudding of 322 wells, and the completion of 286, including 177 producers. The production of petroleum from the outer shelf in 1957 was about 58 percent greater than during 1956 and the production of gas was about 4 percent less than during 1956. Revenues received during the year, as royalties and rentals, totaled $13,306,000.

Activities toward unitization of oil and gas operations involving Federal land were reflected in the approval of 55 new unit plans during the year and the termination of 42 previously approved unit plans, leaving 298 approved plans covering 5,030,642 acres outstanding. On the outer Continental Shelf 3 such plans were approved during the year and the total now stands at 12, embracing 329,156 acres. About 50 percent of the petroleum, 29 percent of the natural gas and 57 percent of the gasoline and butane obtained from Federal lands during the year was produced under approved unit agreements. On Indian lands 5 new units were approved and 3 were terminated, the total number of plans in effect at the end of the year being 30, involving 43,970 acres. There were 117 drilling-unit, or communitization agreements approved during the year, making a total of 680 as of June 30. There was one development contract covering 71,166 acres in New Mexico approved during the year and 182,703 acres were eliminated from the Katalla-Yakataga development contract in Alaska. The total number of such approved contracts outstanding on June 30 was 8, involving 3,254,129 acres.

TOPOGRAPHIC DIVISION

The Topographic Division prepares and maintains the National Topographic Map Series covering the United States and its Territories and possessions. This involves operations and research in five major work phases: aerial photography, geodetic control, photogrammetric and field compilation, cartography and editing, and printing. Related activities include the preparation of special maps and the supplying of advance map materials, aerial photography, geodetic control lists, and map information.

During the year, about 1,490 new topographic maps were published. Mapping projects were under way in every State, the District of Columbia, Alaska, the Hawaiian Islands, Puerto Rico, and the Virgin Islands. About 20,000 topographic maps are now published and distributed by the Geological Survey.

The recommendations of the President's Cabinet Committee on Minerals Policy have had the effect of accelerating the mapping of many quadrangles and the selection of others for new starts to provide topographic bases for geologic mapping. Similarly, additional mapping has been started to implement the recommendations of the

President's Advisory Committee on Water Resources Policy. N and enlarged cooperative programs have resulted in substantial creases in the number of projects which help to meet civil mappi needs. Another important influence affecting the planning of ma ping programs was that of civil defense. The military defense ma ping program, begun in 1951, continued to absorb a large amount mapping capacity and was expanded somewhat as additional prior requests were received.

The Topographic Division, through the International Cooperati Administration, extended technical assistance to accredited represe atives of other nations. Periods of technical training were provid to 4 foreign nationals and tours of our mapping facilities were ranged for about 35 others. Representatives of the Division part ipated in the meetings of the International Society of Photogra metry and the Esselte Conference on Applied Cartography, both h in Stockholm, Sweden, during July and August 1956.

A new cartographic office for map finishing was opened at Me Park, Calif., as part of the existing Geological Survey center.

Mapping Programs and Map Production

Within the continental United States, nearly 1,300 permanen marked triangulation stations were established to provide control areas totaling more than 50,000 square miles. About 4,500 line miles of transit traverse and about 15,000 linear miles of leveli were run, with permanent marks established at intervals of 2 t miles. The computed results of these surveys are made available, request, to other Government agencies and to the public.

In Alaska all field control was completed for the entire 125,0 square miles of the remote Brooks Range area, involving 30,0 square miles of triangulation and trigonometric leveling. Twent five parties utilizing six helicopters and additional conventional a craft were engaged on this project.

Contracts were let for 146,200 square miles of precision aer photography for topographic mapping purposes. The Air Fo delivered aerial photographs covering 11,000 square miles for use compiling topographic maps required by the Department of Defen The project of photographing the Brooks Range area in Alas started in 1955, was completed.

During the year 2,516 maps were sent to the Publications Office printing and distribution. New 1 : 500,000-scale State maps of Oreg and Arizona were printed and new maps of Colorado and Virgi were completed and sent forward for reproduction. Compilati is in progress or planned for the new State maps of Kentucky, Mai Montana, North Carolina, Tennessee, Texas, and Washington.

e 2,516 completed map manuscripts, 1,184 were new standard
pographic quadrangles prepared by the Geological Survey and 64
ere new maps compiled by other agencies but published and dis-
ibuted by the Geological Survey by interagency agreement. Also
cluded were 199 Geological Survey revisions, 708 reprints of exist-
g maps, 59 one-color advance editions, and 77 State index maps.
addition, there were 135 civil editions of maps which had been
ublished by the Department of Defense for military use, and 15
iscellaneous maps.

Considerable mapping was done in relation to civil defense require-
ents, including a continuation of the accelerated program to pre-
are urban area maps of critical targets. Standard urban area maps
r 19 cities were prepared for reproduction and maps for 16 addi-
onal cities are in progress. In addition, 52 one-color map assem-
ies were printed for the Federal Civil Defense Administration at
ales of 1:24,000 and 1:62,500, covering the urban and surrounding
pport areas of seven major cities.

Increased use of helicopters for transportation of personnel and
uipment to remote or high areas difficult of access, was made dur-
g the year. New higher-powered helicopters permitted safe landings
17 peaks over 12,000 feet, including Mount Whitney and Mount
ainier.

After new mapping has been completed, it is necessary to plan a
ogram of map revision. Programs for revising map coverage of
e entire areas of Massachusetts, Rhode Island, Connecticut, Ken-
cky, and Puerto Rico, and of areas in other States and Territories
e underway. Revised maps in Massachusetts, Connecticut, and
hode Island will be published at 1:24,000 scale rather than at the
esent scale of 1:31,680. All other 7½-minute quadrangle maps in
ese three States are also to be converted to 1:24,000 scale during
e fiscal years 1957–59.

An important contribution to defense was continued during the
ar in the preparation of special-use charts for the Aeronautical
art and Information Center of the United States Air Force. The
7 charts of foreign areas prepared for this agency included 123,000
uare miles of new compilation and 40,000 square miles of map re-
sion.

One hundred eighty-five special-use maps were completed for the
rious Divisions of the Geological Survey, the Department of Jus-
e, the Forest Service, the National Park Service, the Federal Civil
efense Administration, and the Army Map Service.

During fiscal year 1957, cooperative programs were in effect in 30
ates, Puerto Rico and the Virgin Islands. The States of Georgia,
nsas, Pennsylvania, West Virginia, the Commonwealth of Puerto
co, and Oklahoma City, Okla., increased their contributions to ex-

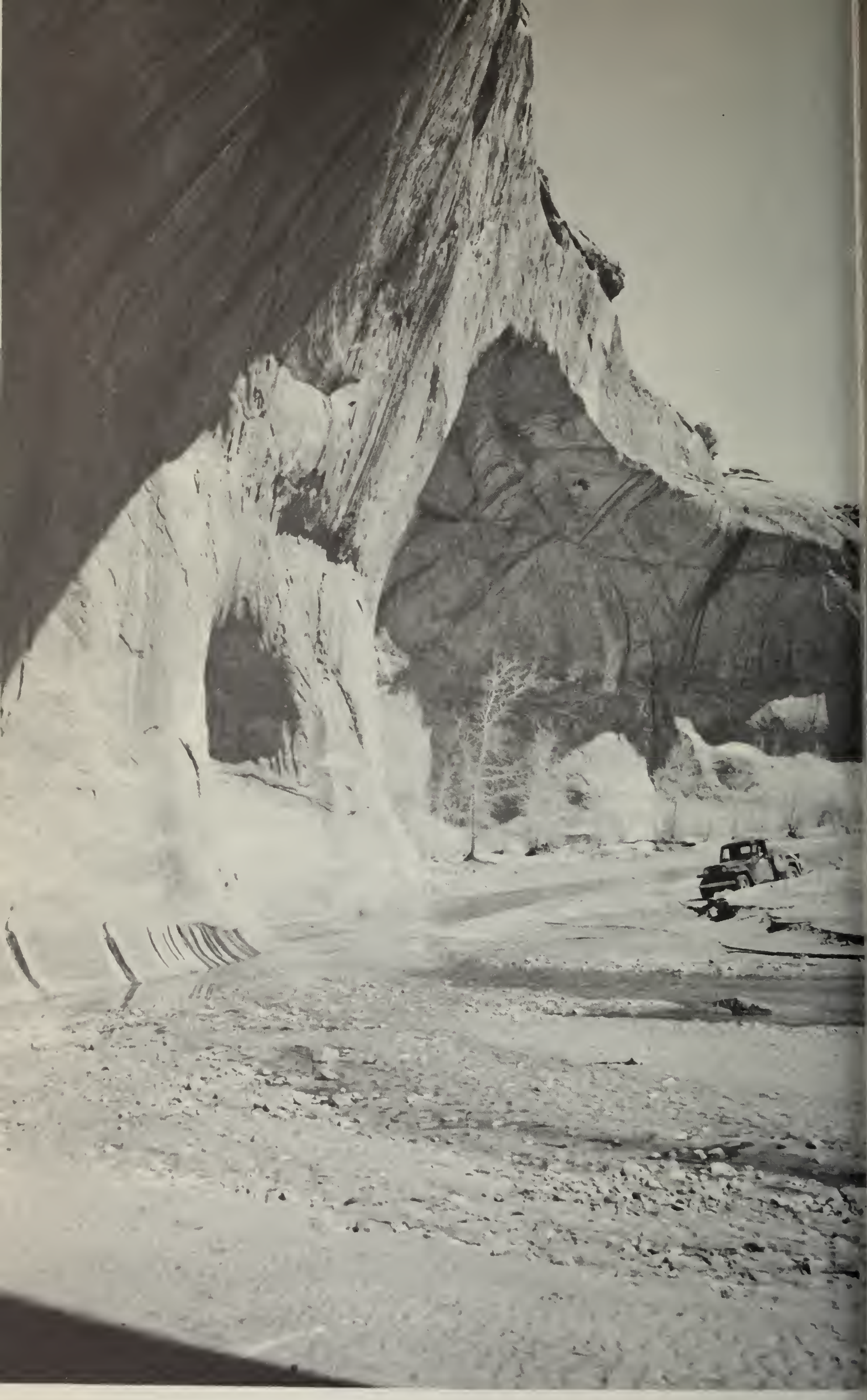


FIGURE 17.—Interior Department topographic engineers often traverse such extremely difficult terrain as this view, showing a Geological Survey truck in the Orange Cliffs area, Utah, indicates.

isting programs and the Lower Colorado River Authority in Texas, State of Ohio, Summit County, Ohio, and the Virgin Islands, started new programs. Total cooperative offerings during the year amounted to about $1,550,000.

A detailed summary of map production is shown in the following table:

Area (in square miles) mapped during fiscal year 1957 for publication on standard scales

[Contour interval, 5 to 100 feet]

State	Area mapped, scale		New mapping	Revised mapping	Total
	1:24, 000	1:62, 500			
labama	245	1, 246	1, 491		1, 491
rizona	1, 059	3, 903	3, 169	[1] 1, 968	[1] 5, 137
rkansas					
alifornia	1, 911	10, 127	10, 554	1, 484	12, 038
olorado	2, 879	961	2, 893	947	3, 840
onnecticut	642			642	642
elaware					
istrict of Columbia	54		54		54
lorida	807		807		807
eorgia	733	1, 821	2, 554		2, 554
aho	464	4, 610	5, 074		5, 074
linois	258	2, 177	1, 483	952	2, 435
diana	3, 102		2, 299	803	3, 102
wa	1, 214	337	1, 551		1, 551
ansas	2, 703		2, 514	189	2, 703
entucky	511		1	510	511
uisiana	437	6, 100	2, 519	4, 018	6, 537
aine	427	2, 437	283	2, 581	2, 864
aryland	884		243	641	884
assachusetts	428			428	428
ichigan	193	3, 087	3, 076	204	3, 280
innesota	715	2, 119	2, 834		2, 834
ississippi		758	758		758
issouri	801		638	163	801
ontana	1, 469	2, 249	3, 718		3, 718
ebraska	1, 751		1, 751		1, 751
evada	92	7, 492	7, 584		7, 584
ew Hampshire	206	1, 515	63	1, 658	1, 721
ew Jersey	131		126	5	131
ew Mexico	283	2, 227	2, 510		2, 510
ew York	1, 964	661	1, 752	873	2, 625
orth Carolina	648	1, 493	2, 091	50	2, 141
orth Dakota	786		786		786
hio	123		123		123
klahoma	1, 000	1, 489	2, 489		2, 489
regon	634	6, 938	4, 116	3, 456	7, 572
nnsylvania	804	1, 020	335	1, 489	1, 824
hode Island	107			107	107
uth Carolina	277	1, 526	1, 287	516	1, 803
uth Dakota	2, 464	10	2, 474		2, 474
nnessee	1, 022		1, 022		1, 022
xas	3, 458	4, 798	7, 324	932	8, 256
tah	4		4		4
rmont		534	85	449	534
rginia	877	629	508	998	1, 506
ashington	1, 026	2, 873	3, 600	299	3, 899
est Virginia	798		798		798
isconsin	225	942	1, 005	162	1, 167
yoming	807	3, 100	3, 907		3, 907
Total	41, 423	79, 179	94, 253	[1] 26, 524	[1] 120, 777
aska		[2] 26, 676	[3] 38, 278		38, 278
awaii	1, 331		1, 331		1, 331
erto Rico	[4] 364			364	364
rgin Islands					
Total	43, 118	105, 855	[3] 133, 862	[1] 26, 888	[1] [3] 160, 750

Includes 175 square miles 1:48,000.
1:63,360.
Includes 11,602 square miles 1:250,000.
1:20,000.

Research and Development

Research and development activities to provide more efficient an economical methods of map production were continued and somewhat accelerated in the past year.

New instruments and equipment for control surveys were developed, tested, and adopted. Levels that automatically maintain horizontal line of sight are now standard equipment for basi leveling.

The Division has purchased a new microwave radio device fo accurately measuring distances ranging from a few hundred feet t about 30 miles. This instrument is expected to reduce the cost o horizontal control surveys materially and at the same time achiev a significant increase in accuracy.

Intensive laboratory research in altimetry continued with the construction of a barostat to provide an absolute standard for calibrating altimeters. A large amount of data on the behavior of altimeter is being accumulated as a basis for developing improved field techniques and office computations.

With the acquisition by the Survey of an electronic compute appropriate problems are being programed for automatic computation. The first major problem will be the conversion of al geographic positions to X and Y coordinates on the State plane coordinate systems. Also in the field of computation and adjustmen four new, improved and enlarged Electrical Survey-Net Adjuster (ESNA's) have been constructed for use in the four regional office of the Topographic Division.

Progress continued in the development of new photogrammetri instruments and techniques. A transforming printer for makin equivalent vertical prints from 20° low-oblique photographs was developed by a commercial firm in accordance with Geological Surve specifications. An automatic electronic dodging device was procure and installed on a projection-type diapositive printer. Preliminar tests indicate a significant improvement in the quality of prints, an plans are being made to equip all diapositive printers with automati dodgers.

A system for precisely controlling the geometric characteristics o diapositives is also being developed as an aid in achieving the greate accuracies now being sought in photogrammetric operations. Th system will include control of film temperature and humidity, precis measurement of film dimensions to insure correct adjustment of th printer, and rigid control of the flatness of diapositive plates.

A complete redesign of the prototype Orthophotoscope has bee undertaken. This instrument, developed by the Geological Surve roduces equivalent orthographic prints from stereoscopic pairs of onventional perspective aerial photographs.

A complete photogrammetric system for compiling contoured maps" of sand configurations in a hydraulic test flume was developed nd tested for the Water Resources Division. The system may be xpected to replace slower hand methods of measuring the effect of ater flow in hydraulic flumes.

The scribing technique is now firmly established in stereocompila- on, field surveying, and color separation, permitting closer inte- ration of those phases of map production.

A map evaluation program was put into operation during the year. he main objective of this program is to provide data with which determine the most efficient and economical methods of map pro- uction. A related objective is to insure that the maps tested and ecked under this program comply with the national map accuracy andards.

Contour-interval plans for 38 States have been prepared. These lans show the proposed contour intervals for both 15-minute and ½-minute topographic maps.

In cooperation with the Interdivision Committee on Photogram- etric Techniques in Geology, training courses in photogrammetry ere provided for geologists and engineers in other Divisions of e Survey. These courses covered the fundamentals of photogram- etry and its application to various activities of the several Divisions.

ap Information

Facilities for supplying information on maps, aerial photography, d geodetic control surveys to Federal, State, and local government gencies, and the public, are maintained at the Map Information Office Washington and at the Division's field offices. Services include er-the-counter map sales for the convenience of the public, com- ercial firms, and government agencies, and assembly of special map, otographic and geodetic control data to meet the requirements of the eological Survey and other Federal agencies.

During the year, geodetic-position data for civil defense purposes ere compiled for key installations of the Geological Survey and for large number of mining facilities throughout the United States as quested by the Bureau of Mines.

The Map Information Office serves as the central depository for e maps which make up the National Atlas of the United States, d maintains a periodically revised list of all maps issued for the las. Seventeen maps of the atlas, showing climatic conditions, pulation, farming, and topographic mapping have been published 1:10,000,000 scale, by four Federal agencies.

The seventh edition of the index Status of Topographic Mapping was published in two sheets. The eighth edition of the index Statu of Aerial Photography in the United States was published in one sheet with inset maps showing Alaska, Hawaii, and Puerto Rico. This edition shows aerial photography for more than 99 percent of the area of the continental United States, 75 percent of the Hawaiian Islands, and 100 percent of Alaska and Puerto Rico.

A list of aerial photographs for areas covered by a set of one hundred topographic maps that illustrate specified physiographic features was prepared for those interested in photography for educational use. The list identifies the photographs, gives the dates and scales of each, and names the agency from which reproductions may be ordered.

Training films on topographic-mapping procedures were widely circulated during the year. They were used by the military services in training personnel assigned to surveying and mapping units and foreign trainees under the military assistance program of the Department of Defense; also by other Federal agencies for foreign trainees under the technical assistance program of the Department of State. The films were shown at surveying and mapping conferences, to engineering groups throughout the country, and were used extensively in educational institutions for instruction in engineering, forestry, and geology. These films were viewed by at least 12,000 persons at more than 400 showings.

PUBLICATIONS

The primary purpose of the Geological Survey is to provide for the people and the agencies of Government, information necessary for the exploration, development, and conservation of our mineral and water resources. As this information becomes available through investigations, surveys, and research, fulfillment of this purpose is served by publication of a variety of reports, maps, and charts. The information is published in part by the Survey, in part by cooperating States, and in part by many scientific journals. These publications include maps of the topographic and geologic features of the Nation, studies of mining districts and mineral deposits, of the composition and structure of rocks and minerals, of fossils and the rocks in which they are found, of geophysics and geochemistry, and studies of streamflow, ground waters, and their chemical quality.

During fiscal 1957, 767 reports including geologic and hydrologic maps were submitted for publication. Of these 308 were for publication by the Geological Survey, 31 as professional papers, 71 as bulletins, 64 as water-supply papers, 9 as circulars, and 133 in the various map series, and the remainder for publication by cooperating agencies or scientific journals.

Preparation

In this period 213 new manuscripts were sent to the printer and 181 were published. Work on new manuscripts prepared in fiscal year 1957 included the editing of 28,259 pages; checking of 5,926 galley proofs and 11,520 page proofs. Printed reports delivered included 17 professional papers, 68 bulletins, 56 water-supply papers, 27 circulars, 4 chapters for the new edition of the topographic manual, and 9 miscellaneous.

Illustrations to accompany reports published by the Survey were prepared at an increased rate. Completed and transmitted for publication were illustrations for 114 reports. The 47 bulletins, 30 professional papers, 32 water-supply papers, 4 circulars, and 1 hydrologic atlas required 1,946 drawings and photographs, of which 134 were for multicolor reproduction.

Final copy for 133 geologic maps for publication in the Geological Survey's map series and 2,516 topographic and related maps were transmitted for reproduction.

Map Reproduction

The following is a summary of map reproduction work completed during the year:

	New	Reprinted
opographic Division maps:		
Standard topographic	[1] 1,458	[4] 376
Standard topographic (engraving)	7	151
Standard topographic (revisions)	[2] 183	----------
1:250,000 scale	[3] 19	[3] 32
Scale conversion	----------	44
Planimetric	3	20
State base	6	11
State topographic indexes	80	----------
Miscellaneous	1	17
eologic Division:		
Geologic quadrangle	15	----------
Mineral investigation	67	----------
Geologic indexes	4	4
Oil and gas maps	11	6
Oil and gas charts	1	7
Geophysical investigations	22	1
Geologic status	1	----------
Miscellaneous investigations	75	----------
onservation Division:		
River survey	10	----------
Total	1,963	669

[1] Includes 1 printed by other Government agency.
[2] Includes 4 printed by other Government agencies.
[3] 30 printed by other Government agencies.
[4] Includes 32 printed by other Government agencies.

These 2,632 new and reprinted map editions comprise 7,683,03 copies of which 7,524,309 copies were printed in the Survey's plant These maps range in size from 18 by 22 inches to 50 by 72 inches.

In addition to the foregoing production, 1,259 jobs comprising miscellaneous maps and other preliminary map services were completed This printing includes 277 maps amounting to 604,320 copies of whic 128 were illustrations comprising 437,925 copies for the Governmen Printing Office. Also, 2,300 type jobs (impressions on cellophane fo map preparation) were delivered, and 827 maps were mounted o cloth.

A summary of the work performed in the Survey's plant includes Reproduction and delivery of 8,128,629 map copies (40,027,177 impressions); preparation of 12,832 photolithographic printing plates 933 printing plates, 9,361 photolithograhic negatives, 23,317 photographic negatives and positives ranging from 2 by 2½ inches t 30 by 40 inches, 11,849 prints ranging from 2 by 1½ inches to 40 b 72 inches; developing and printing 88 rolls of film; preparation o 518 lantern slides; and the mounting of 151 prints.

Distribution

The warehousing of Geological Survey publications is handle through facilities at Washington, Denver, and Fairbanks. Distribution of maps, folios, and circulars from these points is aided b 12 other Survey field offices. Further distribution is carried out b 473 commercial agents who purchase maps for resale to the public

In addition to approximately 35 million items on hand at the beginning of the year, 234,000 copies of 263 separate reports in book an pamphlet form (printed by the Government Printing Office and th Interior Duplicating Section) and 7,683,034 copies of 2,632 new an reprinted maps (printed by the Geological Survey) were received

The distribution of approximately 3,785,000 maps and indexes, an 265,000 book reports and pamphlets during fiscal year 1957 was a increase of 475,000 copies over the preceding year and represente the largest annual volume of distribution by the Geological Surve to date. In addition, more than 115,000 copies of the Survey' monthly announcements of new publications were distributed. Thi total distribution was accomplished through the receipt of more tha 200,000 individual requests and resulted in the receipt of $411,60 from the sale of maps to the public, which amount was deposite as miscellaneous receipts in the United States Treasury.

The total number of copies distributed by the Geological Surve offices as compared with fiscal year 1956 is shown in the followin table:

	Fiscal year 1956 maps, reports and indexes	Fiscal year 1957 maps, reports and indexes	Percent increase or decrease
Washington	2, 438, 250	2, 565, 500	+5
Denver	878, 550	1, 191, 300	+36
Fairbanks	44, 200	36, 900	−17
Other field offices	198, 950	257, 950	+30
Total	3, 559, 950	4, 051, 650	+14

Public Inquiries Offices

Public Inquiries Offices have been established in the following cities: Dallas, Tex.; Denver, Colo.; Salt Lake City, Utah; San Francisco and Los Angeles, Calif.; and Anchorage, Alaska. These offices carry stocks of Survey maps and reports concerning their respective areas, answer all types of inquiries, and direct specific questions on technical matters to appropriate Division technical officers. Maps and reports are sold "over-the-counter," but the offices are not equipped to handle mail orders. Operation of these offices facilitates distribution of the results of Survey investigations to the public.

FUNDS

During the fiscal year 1957, obligations were incurred under the direction of the Geological Survey totaling $53,076,509. Of this amount 59 percent was appropriated directly to the Geological Survey, 27 percent was made available by other Federal agencies, and 14 percent by States or their political subdivisions, and miscellaneous non-Federal entities.

Source and use of funds in fiscal year 1957

Topographic surveys and mapping:		
Geological Survey appropriation		$12, 872, 859
Reimbursements from non-Federal sources:		
States, counties, and municipalities	$1, 545, 078	
Sales to the public of aerial photographs and photographic copies of records	133, 614	
Miscellaneous	49, 638	
		1, 728, 330
Reimbursements from other Federal agencies:		
Bureau of Reclamation	$1, 071, 425	
Department of the Air Force	658, 496	
Department of the Army	539, 623	
Miscellaneous	187, 905	2, 457, 450
Total appropriation and reimbursements		17, 058, 639
Direct State payments		9, 215
Total, topographic surveys and mapping		17, 067, 854

Geologic and mineral resource surveys and mapping:		
Geological Survey appropriation		$6, 776, 314
Reimbursements from non-Federal sources:		
States, counties, and municipalities	$311, 445	
Miscellaneous	18, 098	
		329, 543
Reimbursements from other Federal agencies:		
Defense Minerals Exploration Administration	$468, 558	
Department of the Army	1, 095, 647	
Department of the Navy	334, 220	
Atomic Energy Commission	4, 895, 760	
International Cooperation Administration	774, 267	
Government Printing Office—map reproduction	108, 400	
Miscellaneous	228, 978	7, 905, 830
Total, geologic and mineral resource surveys and mapping		15, 011, 687
Water resources investigations:		
Geological Survey appropriation		8, 511, 012
Reimbursements from non-Federal sources:		
States, counties, and municipalities	$4, 169, 631	
Permittees and licensees of the Federal Power Commission	153, 927	
Miscellaneous	41, 073	
		4, 364, 631
Reimbursements from other Federal agencies:		
Bureau of Reclamation	$1, 112, 406	
Department of the Army	1, 350, 410	
Department of Agriculture	337, 673	
Atomic Energy Commission	348, 529	
International Cooperation Administration	435, 377	
Department of State	104, 787	
Tennessee Valley Authority	87, 952	
Miscellaneous	314, 403	
		4, 091, 537
Total appropriation and reimbursements		16, 967, 180
Direct State payments		963, 470
Total water resources investigations		17, 930, 650
Soil and moisture conservation: Geological Survey appropriation		129, 466
Conservation of lands and minerals:		
Geological Survey appropriation		1, 940, 459
Reimbursements from non-Federal agencies: Miscellaneous		1, 449
Reimbursements from other Federal agencies: Miscellaneous		44, 944
Total, conservation of lands and minerals		1, 986, 852

General administration: Geological Survey appropriation		[1] $950,000
Summary:		
Geological Survey appropriation		31,180,110
Reimbursements from non-Federal sources:		
States, counties and municipalities	$6,026,154	
Miscellaneous	397,799	
		6,423,953
Reimbursements from other Federal agencies		14,499,761
Total appropriation and reimbursements		52,103,824
Direct State payments		972,685
Grand total		53,076,509

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[1] Excludes $534,489 reimbursements from other agencies, which are included under the ubstantive activities.

BUREAU OF MINES

Marling J. Ankeny, *Director*

FOREWORD

AT THE END of the fiscal year, the Bureau of Mines could look back upon its 47th year of service to the Nation as a period of continuing achievement in promoting conservation and development of mineral resources and safety and health in the mineral industries.

During the year the Bureau launched many new research projects and saw industry adopt new equipment and techniques it had developed. The Bureau substantially increased its helium-production capacity and met new challenges in its effort to reduce hazards in the country's mines and mineral-processing plants.

The Bureau planned new undertakings to carry on its mission of helping assure adequate and continuing supplies of minerals necessary for the Nation's economic health and military security.

New projects begun during the year included compilation of detailed information on domestic reserves of copper, lead, and zinc; obtaining basic facts on refractory oxides for ultra-high-temperature use, such as jet-engine components; producing high-purity boron experimentally and determining its properties; developing methods for improving the mineral industries' water-supply situation; and determining the hydration characteristics of gypsum plaster.

Bureau-developed equipment and techniques adopted by industry during the past 12 months included a top-fired scrap preheater that cuts steelmaking costs, a solvent-extraction process for treating uranium ores of the Colorado Plateau, and a feldspar-jigging method adapted for use in coal-preparation plants.

In addition, industry began pilot-plant tests of a Bureau-developed process for separating magnesium and cadmium in magnesium-cadmium-aluminum alloy scrap.

Destined to use Bureau-created processes, two commercial plants were being constructed during the year. One, in Arkansas, was designed to upgrade domestic bauxite for producing alum, and the other, in Oklahoma, to separate columbium and tantalum.

Continuing programs in which definite progress was attained composed most of the Bureau's work during the year. Technical and economic studies covered many commodities among the minerals, metals, and fuels. They included work on problems of immediate national need as well as on long-range assignments.

To meet current requisites, the Bureau collected and analyzed information on mineral and fuel production, requirements, and reserves in the United States and abroad and was a technical consultant to agencies concerned with national defense. It conducted additional research on special problems for such agencies.

Anticipating demands in the more distant future, the Bureau counted gains in its studies to increase the recovery of ores, coal, and petroleum, ranging from research on the basic principles of ground support and breaking rock with explosives to investigations of novel mining techniques that have been found effective under conditions commonly encountered.

During the year the Bureau completed the design and construction of an improved model of the phosphate-rock planer it had developed previously. At year's end, this device was installed for testing in an operating mine in Montana. It is a type of continuous mining machine adapted for steeply pitching, bedded deposits of hard material, and its usefulness in mining other ores than phosphate rock is envisioned.

Development of a similar machine for mining anthracite also advanced, as did studies seeking improved efficiency in all phases of mining bituminous coal and lignite mechanically. Typical was a study of various underground coal-haulage systems to give operators a sound basis for selecting equipment suitable for their mining conditions.

Metallurgical research was active in many fields. The Bureau studied the common metals, both ferrous and nonferrous, to improve recovery and lower production costs, thus making it possible to utilize lower-grade ores.

The Bureau also counted progress in the technology of the newer and less common metals. It developed a method of producing super-high-purity titanium by electrorefining scrap and offgrade sponge and demonstrated that intricate titanium shapes can be produced by casting. In the complex problem of separating the rare-earth metals, it advanced notably in the first stage—developing accurate analytical techniques. Moreover, it continued the quest for better and less costly methods for producing two Bureau-developed metals—zirconium and hafnium.

Studies of coal preparation and utilization were influenced by anticipated growing requirements and by continued depletion of high-grade coking-coal reserves. Methods were sought to clean fine sizes more economically, and the suitability of various coals for use in blends to produce metallurgical coke was determined. Research was continued to learn the effect of preheating coal on the quality of coke. The Bureau also continued research on low-temperature carbonization, a process that appears promising for producing chemicals from coal.

More efficient methods were sought for producing synthesis gas and high-heat-value gas from coal of all ranks, from lignite to anthracite. Other studies dealt with the feasibility of using anthracite (alone or in blends with coke) for metallurgical fuel and with methods of pretreating the anthracite.

The Bureau maintained a well-balanced economic and technologic research program on petroleum and natural gas. During the Suez crisis it provided facts used by Government agencies in authorizing rearranged petroleum production and distribution patterns.

During fiscal 1957, Bureau petroleum-production engineers discussed the Bureau's research program with leaders at industry research centers; these discussions will be reflected in even greater emphasis on basic research and survey-type reporting. Reports on improved production methods, based on Bureau research and on engineering studies of selected oil fields, are being utilized by industry to increase the recovery of petroleum.

As part of its extensive studies in petroleum chemistry, refining, and thermodynamics, the Bureau completed analyses of 274 domestic and foreign crude oils, including 14 from the Middle East. Such information enables refiners to select crude oils best suited for specific end products.

To help assure adequate future supplies of gasoline and other liquid fuels, the Bureau also continued laboratory research on the production of synthetic fuels from coal and oil shale. Regarding coal, this work dealt primarily with improving the two processes—direct hydrogenation and gas synthesis. In oil shale, research centered on laboratory studies involving the nature of kerogen and the constitution and characteristics of shale oil produced by different retorting methods.

The Bureau, world's only large-scale producer of helium, processed more than in any previous year. By year's end, some of the new units at the expanded Exell, Tex., plant were in operation. The increased output from this installation promised to help the Bureau meet essential needs for the next few years. However, increasing consumption, limited known reserves of helium-bearing natural gas, and sale of a growing volume of such natural gas for use as fuel without prior removal of the helium caused concern lest it may be impossible to meet helium demands after 1975–80 unless prompt conservation measures are adopted. The Bureau is cooperating with other Government agencies in attacking the problem of developing adequate ways to prevent the loss of remaining helium resources, most of which are privately owned.

Improved safety and health conditions in the mineral industries remained a prime responsibility of the Bureau. Changing methods, practices, and equipment led to some modification of programs, and special attention was given to problems of mine-roof support, exposure to airborne dusts, coal-mine fire and explosion hazards, and radioactive exposure.

Cooperating with other agencies, the Bureau backed a nationwide campaign to prevent coal-mine roof-fall injuries; by year's end, several hundred mines were enrolled in the program.

Roof bolting, introduced in 1947 to the coal-mining industry by the Bureau of Mines, continued to increase in use and effectiveness. In the calendar year 1956, only 4 fatalities were attributed to failure of bolted roof, compared with 6 in 1955.

The Bureau prepared to extend its approval program to include devices to protect workers against inhalation of radioactive particles. A committee to advise the Bureau on respiratory protection against radioactive materials was formed; it includes representatives of the Atomic Energy Commission, the Atomic Energy Commission contractors, the Industrial Hygiene Foundation, the Industrial Medical Association, the Industrial Safety Equipment Association, and the United States Public Health Service.

As a result of a change during the year in collecting injury statistics, the Bureau will be able for the first time to compute severity as well as frequency rates for the Nation's ore mines. Heretofore this was possible for the coal-mining industry only.

The year's coal-mine safety record was marred by two major explosion disasters, the first of which ended a 26-month disaster-free period. Nevertheless, the Bureau felt that the Nation's coal mines offered safer working conditions generally than in the past. Factors in this decline included 16 years of Federal coal-mine inspection; growing cooperation in safety efforts among State mining departments, mine operators, the mine workers' union, and the Federal Bureau of Mines; and steady extension of accident-prevention training throughout the industry.

Training has been a major phase of the Bureau's safety program since the initial first-aid classes were organized in 1911; it received greater attention than ever during the year. Some 17,000 men took the Bureau's 20-hour coal-mine accident-prevention course, bringing the number completing it since 1947 to approximately 195,000. Experience has shown that this course is most effective when every workman and official at a mine has completed it; accordingly, the Bureau

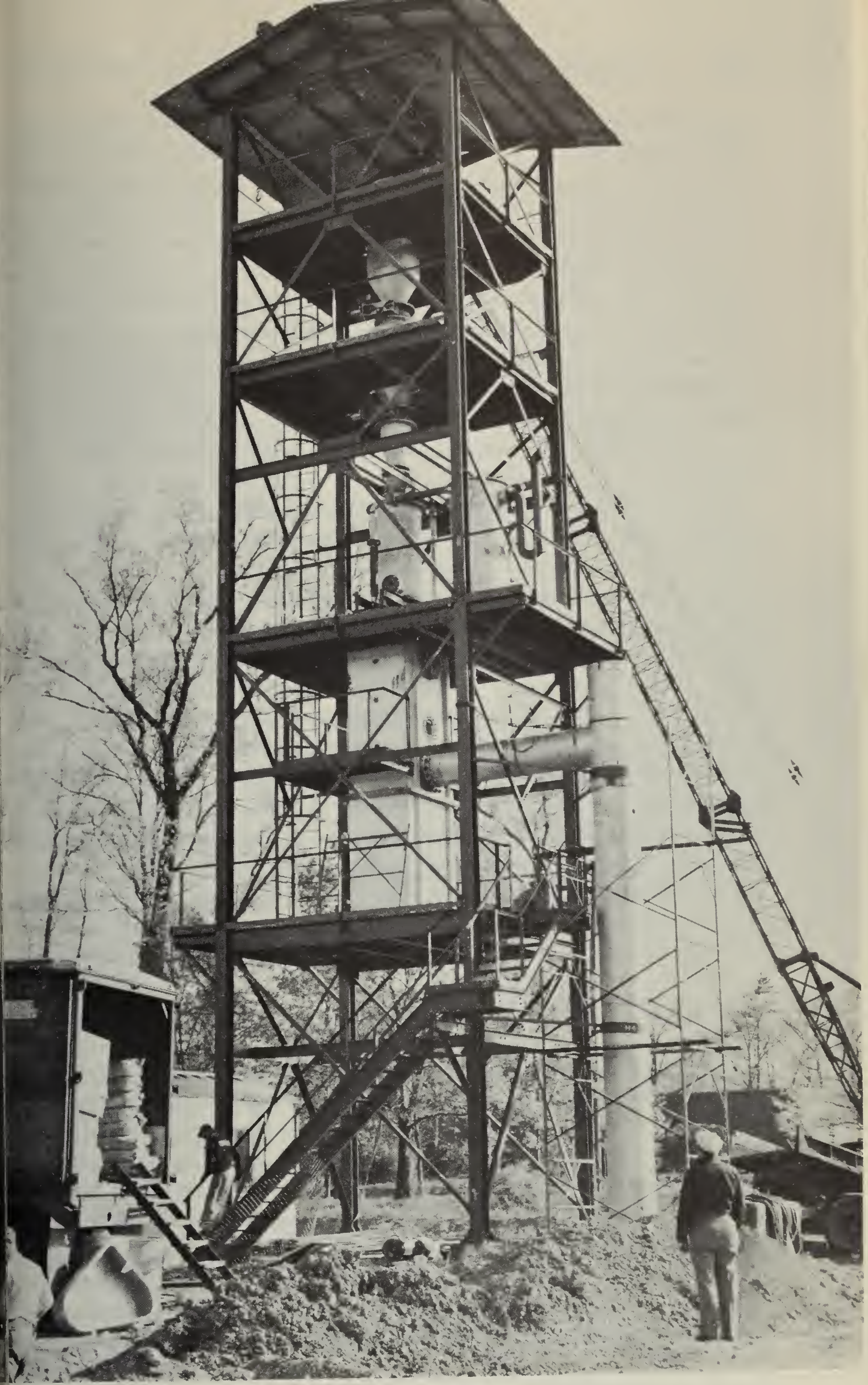


FIGURE 18.—Pilot-scale equipment installed by the Bureau of Mines in Pennsylvania for calcining anthracite preparatory to tests seeking its wider use as a metallurgical fuel.

strengthened its efforts to obtain 100-percent participation, in man instances supported enthusiastically by management and labor. Th course deals with safety aspects of all phases of coal-mine operation in presenting it at a given mine, Bureau instructors emphasize material directly applicable to methods and equipment actually used

Although concentrating heavily on coal mines, the Bureau did no neglect safety training in other branches of the mineral industrie including ore mines, mills, concentrators, smelters, and petroleu and natural-gas operations. In addition, it extended its safety training beyond the borders of the United States for the second successiv year, assigning a two-man team to instruct workmen and manager at several Mexican mining centers in first-aid and mine rescu methods.

Other foreign activities of the Bureau were aimed primarily a assuring a continuing inflow from abroad of strategic and critica minerals in which the United States is deficient.

The Bureau collected and interpreted information on foreign mineral developments. Under a continuing agreement with the International Cooperation Administration, it assigned staff members t assist friendly countries with their mineral problems and accepted foreign technologists for specialized training in Bureau of Mines laboratories. Highlights of the year included research in Bureau laboratories on producing ferronickel from Philippine laterites and serpentines; on designing and constructing a pilot plant to be installed in India for drying, briquetting, and carbonizing lignite; and on metallurgical treatment of Peruvian copper ores.

The foregoing outlines only a few activities of the Bureau during the past 12 months. Details of these and other attainments and endeavors during the fiscal year appear in the sections that follow.

MINERALS DEVELOPMENT

The dependence of United States security and rising living standards on advances in science and engineering became more widely apparent in 1957. Minerals research and development are doubly affected by this dependence: (1) demand from diminishing resources can be met only by improved discovery, production, and use technologies; and (2) fulfillment of the promises of new scientific knowledge often awaits development of materials with special properties and in adequate supply. Recognition of this dependence resulted in expansion of minerals research in the Department and Bureau.

National security continued as a major concern; defense-related assignments had high priority and absorbed a substantial part of the overall Bureau effort.

In 1957, Bureau services to the Office of Minerals Mobilization continued through a liaison office that had been established in 1956, staffed by two top members of the Bureau of Mines serving on rotating assignment and two consultants. This full-time liaison group was supported by the Bureau's entire professional staff, as needed, when particular commodities were under study. Twenty reports for which the Bureau of Mines had prime responsibility were completed, in addition to substantial contributions to eight reports for which the Federal Geological Survey had prime responsibility. The Bureau continued as technical consultant to General Services Administration on mineral-supply problems and carried out research for this agency on several occasions.

The Bureau and Geological Survey continued their participation in selecting and administering Defense Minerals Exploration Administration projects to foster discovery and development of strategic minerals.

As a result of previous planning and organizing, it became possible by mid-1957 to schedule a Minerals Yearbook speedup program aimed at bringing about earlier publication of annual editions of this widely used reference.

As part of its work, and in recognition of its leadership in mineral-industries research, the Bureau was permitted to assign staff members to serve on many committees and boards, including those of the American Society for Testing Materials; the American Institute of Mining, Metallurgical, and Petroleum Engineers; the National Academy of Sciences; the American Chemical Society; and the American Standards Association.

Base Metals

The Bureau's applied physics investigations at three of the Nation's largest underground copper mines recorded signficant progress toward improved operating procedures. Similar studies will begin at open-pit copper mines; they will contribute substantially to ultimate extraction of ore and conservation of resources.

Investigation of copper occurrences in Washington and Alaska during the year continued. Data on mining methods at copper mines in Arizona and Montana were collected and published. In copper metallurgical studies, favorable results for commercial utilization were obtained from continued research on low-grade and complex ores. Greatest strides were made in treating oxide-copper ores by the segregation process. Moreover, significant progress was made in beneficiation, hydrometallurgical, and other pyrometallurgical studies.

Cataloging lead and zinc deposits, experiments to improve the recovery of lead and zinc in finely sized sulfides and in oxide minerals, and research on zinc-base alloys all showed notable progress. Advances were made likewise in metallurgical activities concerned with removing cadmium, germanium, and lead from zinc concentrate.

In response to a need for reserve data for long-range and defense planning, detailed compilations of domestic copper-, lead-, and zinc-ore reserves were undertaken by the Bureau.

Compilation of information on domestic mercury resources continued and was expanded to include facts on mining and processing methods and costs at representative mines. Additional laboratory tests were conducted on a complex mercury-antimony ore from Alaska.

Laboratory results on separating magnesium and cadmium in a scrap magnesium-cadmium-aluminum alloy were so encouraging that private industry tested the process on a continuous pilot-plant scale.

Favorable progress was made in research on recovering copper, lead, zinc, and other nonferrous secondary metals from scrap and waste-metal products by vaporization of metals at low pressure, liquation filtration, and centrifugation of molten metals, electrolysis, and other fundamental techniques.

Four possible methods of recovering several million pounds of tin, plus tungsten, from slag at the Longhorn tin smelter in Texas were devised.

Ceramic and Fertilizer Materials

The Bureau's new phosphate-rock "planer," essentially a continuous mining machine designed for mining inclined, bedded deposits by longwall methods, moved one step farther in its development. Design and construction of a much-improved second model were completed, and the new planer was installed underground in a western mine for testing.

Satisfactory substitutes for strategic muscovite block and film mica continued as the goal of the Bureau's synthetic mica research. A new technique for producing large, oriented crystals of fluorphlogopite mica was investigated, and the effect of composition on mica ceramics made by hot-pressing various synthetic micas was studied. A cooperative agreement was signed with General Services Administration to provide for expanded research by the Bureau on synthetic mica and for monitoring research contracts between GSA and industry. Bureau research under this contract emphasized development of synthetic mica compositions especially suitable for delamination and reconstitution into usable sheets and basic studies of the crystal growth of synthetic mica from melts.

Sampling and evaluation of high-grade clays were continued selectively in accordance with the demonstrable need for assistance to industry in establishing adequate, dependable supplies of specific types of clay in particular areas.

A new project on the beneficiation of Missouri flint, burley, and plastic fireclays was started, in cooperation with industry, to extend the commercial reserves of these clays on which a major part of the great fireclay refractories industry of the Missouri Valley depends.

Accelerated demand for expanded clay and shale lightweight aggregate for building and highway construction resulted in increased activity by the Bureau in sampling and evaluating expansible materials.

Basic research on carbides, borides, silicides, and nitrides advanced, and the more promising of these materials were evaluated for abrasive and refractory applications. A new project was initiated to obtain basic information on refractory oxides for ultra-high temperature uses, such as jet-engine components.

Construction and Chemical Materials

Bureau contributions to solution of fluorspar-industry problems included a study of acid-grade fluorspar specifications. As a result, the Department revised purchase specifications under Public Law 733 to conform with commercial requirements. Fluorspar deposits were examined by Bureau engineers, and flotation tests were conducted on complex ores from Southwestern and Midwestern States. Research was directed particularly toward flotation methods to permit utilization of fluorspar-barite ore as a source of fluorspar. Progress also was made by the Bureau in its research on recovering fluorine (as aluminum fluoride) from low-grade and siliceous fluorspar ores.

A report was compiled on California asbestos occurrences, and preparations were made for diamond-drilling promising areas. A study of the properties of asbestos was directed toward better understanding of the characteristics that make each variety particularly effective in its specialized uses.

The Bureau continued to accumulate information on the formation and properties of synthetic asbestiform fibers. Progress in this phase of the Bureau's asbestos program was aided by installation of an electron microscope to obtain vital information on the physical structure of the complex fibers.

Substantial gains were made in a nationwide survey of sulfur resources. Meanwhile, laboratory research began on processes to utilize submarginal deposits and byproduct supplies now wasted.

Bureau studies revealed that recovery of lithium minerals from mill tailing can be increased substantially, and further study of this problem was scheduled.

Research was started on methods of improving the water-supply situation of the mineral industry. A series of tests indicated that contaminated water available in the Salt Lake drainage area was unsuitable for use in flotation processes. Research will continue on th effects of specific contaminants and on treatment methods.

Close cooperation was maintained with industry and with Government agencies involved in the national highway program, particularl regarding information on the capacity of the cement industry t meet program requirements. Studies of current methods of minin and processing mineral aggregates were made at several typica operations.

Bureau physicists, using a unique, high-speed, photographic technique, have developed a revolutionary new theory of how rock i broken by explosives, and this research was extended during the yea to include a study of its application in stone-quarry blasting.

A research project on the hydration characteristics of gypsu plaster began during the year and provided fundamental thermodynamic data which may throw new light on the behavior of gypsu in use.

Research was started on the production of high-purity boron an on the determination of its properties and utility.

Ferrous Metals and Ferroalloys

Studies were made on Lake Superior nonmagnetic taconites an on low-grade and complex iron ores in the Southeastern, Western and Northwestern States and Alaska. A report known as "Th Iron-Ore Materials Survey" was published by the Bureau.

In cooperation with industry, the Bureau obtained improvement in blast-furnace efficiency by sizing and agglomerating iron ores an by varying operating techniques. Basic research in high-temperature reactions was completed. A top-fired scrap preheater develope by the Bureau to cut steelmaking costs, was adopted by industry Work went ahead on utilizing western ores in producing stainles steels. Factors that affect uniformity of steel and the use of rar earths in steel manufacture were investigated.

The use of subgrade domestic chromite resources was explore through studies of chemical, pyrometallurgical, and physical beneficiation methods and production of usable chromium alloys. High-purity ductile chromium and its alloys were supplied to independen laboratories for special observations. High-purity chromium wir supplied by the Bureau was irradiated for experimental use i treating cancer. Results of research on using subgrade domesti chromites to produce chromium and chromium refractories wer published.

Manganese oxide pellets of good physical structure and chemica analysis were created experimentally from low-grade manganese ma erial from the Cuyuna range in Minnesota, using the Bureau's high-emperature sulfatization process. Reports were published on minng and metallurgical investigations involving western and eastern ow-grade manganese ores. Manganese-extractive processes studied ncluded percolation leaching with sulfur dioxide and roasting low-rade ores in contact with mixtures of ammonium compounds, folowed by leaching with water.

Molybdenum research was aimed at perfecting a process to prouce massive ductile metal by laboratory bomb reduction. Yields xceeding 90 percent of soft ductile molybdenum were obtained exerimentally. A study of the application of physics to block caving t the Climax molybdenum mine in Colorado continued, and a Maerials Survey on Molybdenum was published.

Bureau of Mines research led to promising improvements in roastng and leaching techniques for nickel-cobalt ore at the United States overnment-owned plant, Nicaro, Cuba. A resource study of nickel-earing laterite in Puerto Rico began in cooperation with the Puerto ican Economics Development Administration.

Studies of low-cost methods for producing vanadium led to experiental production of high-purity ductile vanadium.

A review of tungsten technology in mining and milling, appraisal f western tungsten deposits, and research to improve flotation and ydro-metallurgical techniques continued as part of the Bureau's rogram. Results of a basic mineralogic study and on recovering ngsten from tin slags were published.

ight Metals

A process to upgrade domestic bauxite into a material suitable for lum production, developed by the Bureau of Mines, is to be used in plant being constructed in Arkansas by a large chemical producer. y processing raw material not previously considered usable, the ompany operation in the area will be prolonged 20 years.

Additional research on developing raw materials for producing umina included a critical analysis and review of all known processes r obtaining alumina from nonbauxitic materials. Results of the udy will be published and used to guide further research.

To advance the conservation and utilization of the limited domestic pply of bauxite, a project was started to devise underground ming methods for increasing recovery at high-grade deposits.

The Bureau expanded its program of magnesium-alloy research to clude studies on the vibration-damping capacity of commercial agnesium alloys. This work will establish authoritative data that ay lead to selection of magnesium for wider application in uses volving the absorption of vibration-induced stress.

Investigations of titanium-mineral deposits in the United State were started to provide information on future sources of supply fo the expanding titanium metal and pigment industries. Deposits i California, Idaho, Wyoming, Colorado, Oklahoma, Texas, Virginia Maryland, and Alaska were studied, and preliminary beneficiatio tests of some of the ores were made.

Under a cooperative agreement with the General Services Administration, titaniferous magnetites from New York and Wyoming were smelted by the Bureau to yield high-titania slag and pig iron. Slag produced in previous experiments was chlorinated to make titanium tetrachloride suitable for reduction to titanium metal.

Hyperpurity titanium metal was made by electrorefining titanium scrap and offgrade sponge. The resultant metal was purer than any available commercially. Samples were distributed for evaluation to laboratories conducting Government research.

An experimental arc-melting furnace capable of pouring 180 pounds of metal was built for casting titanium. The Bureau demonstrated that intricate shapes could be cast in titanium; examples included several 2-inch gate valves and 1½-inch diaphragm valves. These are believed to be the first all-titanium valves made by casting.

Rare and Precious Metals

Solvent-extraction processes developed and tested by the Bureau were adopted in several uranium mills treating ores from the Colorado Plateau. Further progress was made in extracting uranium from South Dakota lignite and thorium from Colorado ore.

A handbook on uranium exploration and production was published to assist prospectors and miners, and preparation and publication of a series on mining methods and costs at various uranium mines were continued to assure dissemination of information on the latest and most efficient mining practices. The Bureau, continuing a contract, with AEC, tested more than 15,000 mineral samples submitted by the public and believed to contain radioactive elements.

Research on rare-earth metals went ahead at the Reno, Nev., station. Analytical techniques were emphasized as test conclusions depend upon accurate analyses which are extremely difficult in the case of the rare-earth elements. Analytical methods progressed satisfactorily, and more effort will be spent in developing extraction and refining processes for producing individual rare-earth metals.

At the Northwest Electrodevelopment Laboratories, Albany, Oreg., the Bureau continued to investigate the metallurgy of zirconium and hafnium to reduce production costs and improve the purity and ductility of both metals. Work was done to improve fabricating techniques, attention being given to casting, spin casting, extruding, rotary forming (spinning), and drawing. The first part of a bibliography of the literature on zirconium and hafnium was issued.

Reconnaissance on sources of selenium and laboratory research on ores representing a potential reserve were continued by the Bureau throughout the Western States under cooperative agreement with the General Services Administration. At Salt Lake City, Utah, the Bureau opened a program for recovering selenium and uranium from seleniferous uranium ores. A field test for selenium was developed and described in a publication to aid prospectors.

A private company began building a multimillion-dollar plant in Oklahoma for treating columbium-tantalum concentrate. It will use a separation process developed at the Bureau Albany, Oreg., station.

Seeking to develop additional supplies of beryl to meet renewed demands for beryllium, the Bureau continued research on flotation methods that have commercial promise of recovering beryl from pegmatites of the Black Hills, S. Dak., and Kings Mountain, N. C., areas.

Mine ores and mill and smelter products were surveyed to find and evaluate sources of rhenium.

Miscellaneous Research on Minerals

Bureau scientists and engineers conducted important research on various phases of general mining technology both in Bureau laboratories and in operating mines. These studies included design and development of instruments for obtaining information relating to rock-stress problems, determination of fundamental physical laws governing the breakage of rocks by explosives, basic research on the behavior of caving ground in mining operations, physical property tests of rock types, investigation of methods for detecting ground movement, and design of underground mine openings for maximum safety and efficiency. Research on drilling methods and studies in improving mining methods through abatement of noise and vibration were also parts of the Bureau mining-investigation program.

Fundamental studies through precise measurement of the properties of mineral substances and compounds, important in metallurgical and ceramic technology, were carried on, and the information thus derived was correlated and made available to engineers and scientists developing new metallurgical and chemical processes for treating natural ores and mineral products. Research also was directed toward developing new mineral-dressing procedures and analytical techniques that will give engineers more complete and exact knowledge of ways to win metals and minerals from their ores.

BITUMINOUS-COAL RESEARCH AND RELATED ACTIVITIES

Output of bituminous coal continued to be high and was only percent below that in the preceding fiscal year. The outlook f steadily increasing energy requirements, both at home and abro created general awareness of the need for increased research in cc production, distribution, and utilization and resulted in plans f expanding and modernizing this industry. These will prove of gre importance to the national economy.

Technologic Research

The Bureau's technologic research on bituminous coal during tl year was divided into two general categories: (1) Continuing studi to improve ways by which well-established coal-mining, preparatio and utilization methods could serve industrial development; and (2 exploration of wholly new approaches to coal mining, preparatio and utilization.

Underground coal-haulage systems were studied to provide indu try with a sound basis for selecting equipment for use under diffe ent typical mining conditions. In another study of eight auge mining operations, productivity per unit shift was shown to b superior to that by conventional mining.

Bureau coal-preparation research was directed primarily towar improving methods for cleaning fine sizes of coal. As a result o these studies, a method known as feldspar jigging was introduce commercially to the coal industry of this country. Moreover th Bureau's basic work on coal flotation has resulted in important findings concerned with factors of cell design and reagent preparatio leading to significant increases in rates of recovering product Liquids-solids separation methods were studied in efforts to minimize stream pollution from discharges by preparation plants. Equipment analyzed included vibrating screens, cyclone thickeners, an combinations of these, as well as flocculation and vacuum filtratio devices.

The utilization of lignite for fuel and chemicals was fostered b the Bureau through development of data on lignite size-reductio characteristics and requirements of power for size reduction. Ways were sought to prevent troublesome freezing of lignite in railroad cars during the winter.

The largest use of coal today is in generating heat and power. Bureau of Mines studies toward achieving greater efficiency in these processes included work on flow patterns of gases and powder suspensions, devising new methods for calculating the temperature of flames.

aluating the performance of large furnaces used by electric utilities d other industries, and aiding the prevention of air pollution.

Another essential use of coal is to make coke for producing metals om ores. In studies of cokemaking different types of coal and their ends were investigated; work continued on the effects of preheating al on the quality of coke; fundamental information was obtained the mechanism and rate of coking; and coals from Kentucky, West rginia, Pennsylvania, Utah, and Colorado were tested in a con- uing survey of the coking properties of bituminous coals.

The Bureau believes that low-temperature carbonization may be- me a commercially feasible method for obtaining chemicals from al. Small-scale carbonization assays were made on lignites and als from 10 Western States, Alaska, and 9 foreign countries, and ot-plant tests were completed on samples from 5 States and the ilippine Islands. Projects in the Bureau's low-temperature tar oratories centered on determining variations in tar with rank of al and properties of these tars, extracting their components, and ocessing them into more valuable chemicals.

Experts believe that conversion of coal to pipeline gas, liquid fuels, d chemicals will become a necessity in the future, since our coal erves greatly exceed those of all other fossil fuels. Two approaches being studied: Treatment of coal with hydrogen (itself derived m coal) and total gasification of coal followed by synthesis of or- nic compounds from the gas.

In coal hydrogenation small-scale studies showed that small ounts of hydrogen sulfide enhance the activity of iron catalysts. ganometallic compounds were found to be suitable catalysts. A v type of reactor was developed for studying coal hydrogenation ring rapid heating and at much higher temperatures. Pilot-plant ts were made to study problems of converting coal to jet fuel, using process with simpler equipment and considerably lower pressures n those required for the usual hydrogenation process.

Research on the Fischer-Tropsch process (the catalytic combination hydrogen and carbon monoxide gases derived from coals) included ting steel plates, iron wire, iron-wire screen, and steel wool as cata- ts. Researchers ascertained that the poisoning effect of sulfur on n catalysts depended not only on the kind of sulfur compound but o on whether it was introduced by impregnation of the catalyst ore synthesis or by addition to the gas mixture during synthesis.

Pilot-plant studies were begun on a modification of the Fischer- opsch process in which hot gas is recycled to remove the heat of ction. This process now appears technically feasible because of es of catalyst and catalyst pretreatment developed by the Bureau Mines.

Coal-to-gas research was directed toward developing processes fo producing synthesis gas and a substitute pipeline gas, improvin auxiliary processes, and gaining a better understanding of the mechanism and kinetics of gasification. Pressure gasification of coal wit oxygen and steam was resumed to determine the effect of operationa variables.

A new concept in gasification is the use of nuclear heat for th energy of reaction. In cooperation with the Atomic Energy Commission, a conceptual design for a nuclear reactor was completed, an studies were made of component parts and materials.

A semicontinuous pilot plant was operated to develop engineerin data on the steam-iron process for making synthesis gas and methan from producer gas. If successful, this process would eliminate us of costly oxygen and, for methane production, use of the methanatin reactor also. Direct heating of a low-rank coal-water slurry in externally heated reactors also eliminates oxygen, and experiments wit lignite have shown such promise that the projected nuclear-hea process incorporates this concept.

Methods for removing solid and gaseous impurities from synthesi gas were studied. Further facts were obtained on the hot potassiu carbonate gas-purification process, using conventional scrubbers. Thi Bureau method has been recognized in adoption by industry in th United States and abroad.

In its underground gasification tests, the Bureau completed burning the first hydraulically fractured gasification area. A new site wa prepared similarly, and porosity within the fractured area was increased by refracture with water at air-injection boreholes. Small-scale electrolinking experiments were made to determine the mechanism of this process.

Bituminous-Coal Economics and Statistics

Bureau of Mines technoeconomic studies of various phases of the bituminous-coal industry have resulted in assembly of information invaluable to industry, to State and Federal Government agencies, and to the Bureau both with regard to the production and utilization of this important energy source and in planning technologic research on bituminous coal. At year's end, plans were underway for broadening the scope of the technical-statistical program and economic research pertaining to coal production and consumption, to competitive energy factors as they relate to coal, and to other economic developments as they concern the coal and coke industries.

So that industry and Government will have adequate information for appraising the position of coal throughout the Nation's expanding economy and rapidly growing energy requirements, the Bureau ias a program for assembling and publishing substantially expanded nformation about bituminous-coal marketing and distribution. This rogram will start at the earliest possible date.

Background information was prepared for guidance in solid-fuels nobilization requirements, particularly as regards regional coal availbility and coking-coal and coke productive capacity in their relation o steel production and other important uses for coal, including power eneration.

EXPLOSIVES AND EXPLOSIONS RESEARCH AND TESTING

Vork on Explosives

Continuing its long-range investigation of factors influencing the afety of permissible explosives, the Bureau placed increased emhasis on a study of the relative incendivity of explosives. One early esult was demonstration of the role of small concentrations of sodium hloride in reducing this incendivity. As part of the Bureau's reguar testing program, out of 31 field samples tested for conformity to ureau-approved specifications, 2 failed, and the lots of explosives nvolved were declared nonpermissible. During the year, Bureau esearchers made 2,581 tests of permissible and other explosives and f hazardous chemicals.

The potential hazards of a variety of materials, including zirconium nd rocket propellants, were also extensively investigated. In conection with propellants and in other studies concerning explosives, he Bureau began studying transitions in explosives from deflagration detonation. Considerable attention was paid to the rapidly growg use of sensitized, fertilizer-grade ammonium nitrate in open-pit lasting.

ust- and Gas-Explosion Investigations

Research went ahead on the fundamentals of ignition and flame ropagation. Exploitation of new experimental approaches to mechnisms of ignition was begun. Burning-velocity measurements were xtended to above-atmospheric pressures, and research continued on undamentals of gas-burner design and on the production of noxious roducts by rich flames.

Increasing mechanization of the Nation's coal mines continued to reate new safety problems, for example—production of explosive al dust in rapidly developing entries. Answers to many of these roblems were sought at the Bureau's Experimental Coal Mine. ransport and deposition of float dust by mine ventilating systems ere studied along with ways to improve or supplement the effec-

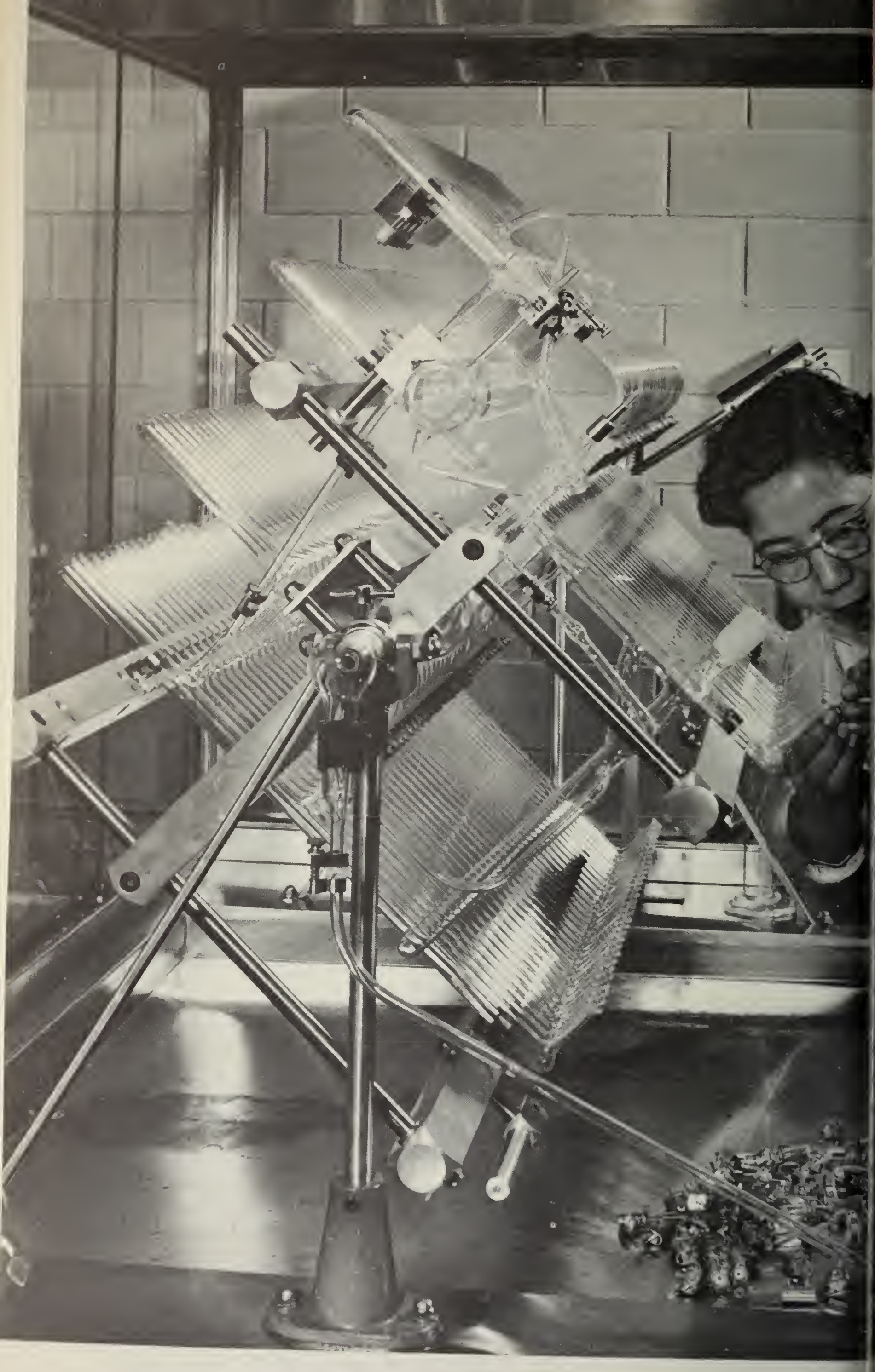


FIGURE 19.—As part of its search for new uses of coal, the Appalachian Ex ment Station of the Bureau of Mines at Morgantown, W. Va., employs countercurrent distribution apparatus in its low-temperature tar laborat

veness of generalized rock dusting for neutralizing the hazards of al-dust accumulations.

Explosibility characteristics of 56 industrial, mineral, and agri- ltural dusts were determined. Research was resumed on design ctors basic to attenuating dust explosions by venting. Special in- stigations were conducted on the action of added inert dusts in ducing explosion pressures and on the use of atmospheres with duced oxygen concentrations below which ignitions will not occur.

Flammability characteristics were determined for a wide variety gaseous, vaporous, and/or liquid systems of commercial or military terest.

The Bureau assisted Federal agencies, municipal authorities, and dustry in investigating fire and explosion disasters. Typical was e one at Luckenbach pier, Brooklyn, N. Y., in December 1956.

ANTHRACITE

thracite Research

In line with increased funds granted by Congress, the scope of Bureau's research activities on anthracite was broadened. New as of research were investigated, and studies underway were celerated.

asification of anthracite has prospects for development as a large- nage market. Past research by Government and private firms s reviewed critically to determine the various processes by which hracite could be gasified. Commercial-scale tests of two grades anthracite were underway in a fixed-bed, Lurgi gasifier at the se of the fiscal year and should provide adequate and reliable data determining the economics of the process and also the adapta- ty of the coal.

tudies of the use of calcined anthracite were conducted in a coal- pany-service foundry cupola. The regular fuel charge for this ola is 60 percent raw egg-size anthracite and 40 percent + 6-inch ndry coke. Calcined anthracite substituted for the entire fuel rge resulted in operation considered completely satisfactory for ditions at this particular foundry and produced metal tempera- es of essentially the same degree as those obtained with 100-per- t coke charges, at the same fuel: metal ratio.

aboratory-scale experiments by the Bureau on an agglomerate hracite metallurgical fuel resulted in producing briquets superior resistance to impact and abrasion to metallurgical coke. These uets were composed predominantly of anthracite fines, with small ntities of bituminous coal and coal-tar pitch added.

Laboratory experimentation to define the chemical characterist of anthracite have indicated that this material can be oxidized unc suitable conditions to produce soluble products whose characterist have not yet been defined.

The anthracite-preparation research program was reactivated, a equipment was obtained to conduct tests on heavy-medium cleani systems and a further study of high-velocity cyclones as deslimin sizing, and deashing equipment.

The results of preliminary tests with the Bureau-designed pne matic coal planer warranted extensive design and development wor Industry needs a continuous mining machine for beds pitching b tween 10° and 25°, and the planer (operating on a longwall syster appears to offer one solution. The study will proceed under the fo lowing plan: (1) To establish in a mine of the cooperating anthr cite-producing company a longwall system of mining, employi conventional cutting machines and loading with a rigid-blade plane (2) to develop the Bureau's pneumatic planer; and (3) to ful mechanize the roof-support system. Funds were obligated for pu chasing major equipment items for phase (1). Additional iten necessary for phase (1) will be purchased with 1958 fiscal ye money.

The conveyor system was removed from the Bureau-design scraper mucking machine and the scraper end tested in sinking a 3 rock slope. The scraper performed well, without alteration, but t work had not progressed far enough for conclusive data to be c tained on performance. A method of caving longwall, advancing, h been designed by the Bureau for productive operation in a new min should bed conditions prove favorable when the slope to open the mi has been completed.

The Branch of Mining was assigned a hydraulic mining project, t ultimate objective of which is to establish an underground minin system in which the operations of winning, gathering, transportin and hoisting mined materials are accomplished by hydraulic metho As a first step a special nozzle design was created with which it proposed to concentrate the energy of the water ejected, in jet fashio some distance in front of the nozzle. In this way the energy will pinpointed for the most effective action on the solid coal face.

During the year breakers in the anthracite region were sample at the request of operators, and the current coal production w analyzed.

Anthracite Flood Control

The Branch of Mine Drainage, headquartered at the Anthraci Experiment Station, Schuylkill Haven, Pa., has as its principal fun ions the review and evaluation of mine-drainage projects in conormity with the requirements of Public Law 162, 84th Congress, 69 tat. 352, for making financial contributions by the Federal Govrnment to match expenditures by the Commonwealth of Pennsylvania or such projects.

Thirteen mine-drainage projects were reviewed and, after evaluaon, were reported to the Director of the Bureau of Mines for approval y the Secretary of the Interior. The estimated cost of these projects as about $5,500,000, of which one-half will be contributed by the ederal Government.

Additional drainage projects will be analyzed and evaluated with ngineers of the Pennsylvania Department of Mines and Mineral ndustries and in consultation with the Federal Geological Survey nd representatives of interested anthracite-producing companies. hese projects likewise will be submitted to the Secretary of the nterior for approval.

conomics and Statistics

Weekly reports were issued on production. Each month, data on roduction, distribution, stocks, wholesale mine prices, and hours and rnings were released. Also prepared and distributed were annual ports on production, employment, and distribution. These reports rovided industry and others concerned with anthracite reliable formation for evaluating the many economic problems of the dustry.

PETROLEUM AND NATURAL-GAS RESEARCH

roduction, Transportation, and Storage

Information presented in a Bureau of Mines report, combined with e benefits derived from hydraulic fracturing, have resulted in the illing of 100 new producing wells in the 34-year-old Stevens oil ld in Arkansas.

A comprehensive review of methods of core analysis used by the ajority of petroleum companies was made by an American Petroum Institute Pacific Coast District Study Committee; the recomnded API procedure will be based in part on the Bureau's method.

Programing for an electronic computer to calculate the effect of the rmeability profile of a reservoir on the recovery of oil progressed isfactorily, and studies of relative permeability measurements and led displacement measurements were completed. Research on the oductivity of natural-gas wells through laboratory studies to instigate deviations of actual flow from theoretical predictions proessed on schedule.

Engineering work was completed or neared completion on selected fields in Arkansas, California, Kansas, Louisiana, Montana, Oklahoma, Texas, and West Virginia. A report giving analyses of brines from oil-productive formations in Oklahoma was published, as well as one on electrical resistivities of oilfield brines in southern Arkansas and northern Louisiana. Work progressed on studies of trace constituents of oilfield brines.

Research projects on radioactive tracers went forward, and numerous additional gamma logs were made with a new Bureau-designed transistor-operated logging probe that will provide information for stratigraphic correlations. Also, much interest—particulary from medical-research institutions—has developed in tracerwork related to the design of a Geiger-tube checking device.

Research on surface-active constituents of crude petroleum continued. The stabilities of free porphyrins, purified vanadium-porphyrin complex, and the porphyrin content of a crude oil subjected to irradiation with high-energy X-rays were determined. New methods to separate metal-porphyrin complexes from crude oil were investigated. The effects of high-dosage gamma irradiation on porphyrins and porphyrin-metal complexes were observed by Bureau researchers.

Sequestering and chelating agents were received from a large number of chemical companies for use by the Bureau in experimentally treating water for flooding oil-bearing formations. Laboratory work was completed on the effects of interstitial clays upon the amount of water originally present in oil-bearing sands. A study on the effect of foam produced by surface-active chemicals to increase oil recovery in waterflooding and a series of foam-viscosity tests were completed. Reports were written on clay minerals and permeability of Appalachian oil sands. Analyses and physical property determinations of core samples from Rocky Mountain and Appalachian oilfields continued. A report was completed on the study of mixtures of a nonionic detergent and citric acid in water injected for secondary oil recovery.

Thirty-eight scientific and engineering reports were finished on research related to primary and secondary petroleum-recovery operations and Missouri River Basin studies.

Petroleum-production engineers of the Bureau of Mines visited 14 petroleum-industry research centers to discuss the Bureau's petroleum-production-research program, with the purpose of strengthening it. The consensus was that the Bureau should expand its basic research and survey type of reporting.

The Bureau presented a report on deliverability tests of gas-storage projects in Oklahoma, Pennsylvania, and West Virginia to the Operating Section, American Gas Association, in San Francisco, Calif. The association has contributed additional funds for expanding the ooperative study of deliverability of gas from wells in underground torage projects to devise remedial measures for increasing the flow f gas into well bores.

Chemistry, Thermodynamics, and Refining

Major emphasis in research on sulfur in petroleum was placed on study of the fraction of Wasson, Tex., crude oil boiling from 150° o 220° C. Several individual compounds were identified, and the Bureau proved that sulfur compounds included within this boiling ange are largely thiophenic. Four organic sulfur compounds were urified rigorously as reference standards in a related phase of the esearch. Spectral and other properties for many similar compounds vere determined or were obtained through cooperation with other aboratories.

Nitrogen-compound concentrates were prepared from Wilmington, Calif., crude oil by deasphalting, adsorption, and precise distillation echniques, preparatory to identifying individual compounds. Two rganic nitrogen compounds were purified as reference standards. atisfactory purity of compounds was close to achievement for sevral others.

Thirty-six compounds containing sulfur, nitrogen, oxygen, or flurine and hydrocarbons of immediate or potential importance in peroleum technology were studied in the Bureau's thermodynamics aboratories at Bartlesville, Okla. Such properties as heat capacity, eat of combustion, vapor pressure, and heat of vaporization were easured precisely. On compounds for which measurements were ompleted, experimental data were translated into wide-range and niversally useful thermodynamic functions. The excellence of therodynamics research at Bartlesville was recognized internationally hen a staff member was invited to speak on calorimetric methods r determining the purity of organic compounds at an international mposium in Amsterdam, Netherlands.

Analyses were completed for 274 domestic and foreign crude oils, cluding 14 from important Middle East fields. A comprehensive port by the Bureau containing analyses of crude oils from 470 of e largest fields in the United States soon will be published and will a major contribution to petroleum literature.

Specialized analytical work on crude oils and their fractions proressed under agreements with the Air Materiel Command and the Air echnical Intelligence Center.

Some work was done on diesel-type ignition of pure hydrocarbons, sing the constant-volume combustion apparatus developed by Buau scientists. Current and previously obtained autoignition data were being correlated to develop reliable relationships between ignition reactions and conditions of combustion.

Also continued were surveys to define the quality of motor gasolin and aviation, diesel, and burner fuels being marketed throughout th Nation.

Research on utilization of gasoline and distillate fuels was directe mainly toward investigation of the basic causes of instability, wit emphasis on studies of the stability effects of additives and mino constituents of fuels and of oxidation under controlled condition Promising results were obtained in developing accelerated agin tests, using both X-ray and ultraviolet irradiation techniques.

Twenty reports of the Bureau's chemistry, thermodynamics, an refining work were prepared for publication. These are additiona to many special reports supplied cooperators and supporting Government agencies.

Research to relate the composition of internal-combustion-engin exhaust gases with fuel composition and engine operating condition was continued at the Petroleum Experiment Station, Bartlesville Okla., as cooperative work with the United States Public Health Service on air pollution. Exploratory engine tests, using several fuel representing typical gasoline blending stocks, indicated no gross differences in exhaust-gas composition; however, potentially significan differences were observed in minor constituents in concentrations up t 5 percent. Much effort was put into developing exhaust-samplin equipment and techniques, and, in cooperation with the Coordinatin Research Council, of a gas chromatographic analysis method. Gratifying progress was made in both these essential phases of the research

Petroleum and Natural-Gas Economics

The outstanding event of the year affecting the worldwide petroleum situation was closing of the Suez Canal in November. This action necessitated complete rearrangement of world supplies of crude petroleum. Data provided by the Bureau in its regular reports on crude-oil production, stocks, refining, and demand for refined products in all parts of the world proved essential in effecting this rearrangement. Also, the Bureau's forecasts of market demand for crude oil in this country were instrumental in getting the oil-producing States to raise their allowables and production to meet the sharply higher demands imposed by the Middle East crisis.

Preparatory work was done on proposed additional projects, and several minor improvements were made in regular reports. The Bureau proposes to start these projects in fiscal 1958:

1. Obtain better statistics on crude-oil production through the cooperation of State agencies.

2. Improve surveys of refinery capacity by obtaining more detailed formation on processing equipment.

3. Explore possibilities for reporting production and capacity to roduce petrochemicals.

OIL-SHALE RESEARCH

After the shutdown of all development work by the Bureau on e Naval Oil Shale Reserves at Rifle, Colo., in June 1956, oil-shale vestigations were confined to laboratory work at the Laramie, Wyo., etroleum and Oil-Shale Experiment Station.

aboratory Research

Work at the Laramie laboratory was carried on under three main adings: Constitution of oil shale and analyses, conversion of oil ale and products, and characterization of shale oil and spectrometry.

Nearly 5,000 oil-yield determinations were made on cores and cutngs from Colorado and Utah shales. Some of these results were scribed in a recent Bureau publication.

Studies of the constitution of kerogen from Colorado oil shale ntinued along several lines: Determination of low-temperature ermal extracts, reduction and decarboxylation of kerogen acids, and actionation of kerogen acids by partition chromatography and inumental analysis.

A paper, Hydrogenolysis of Colorado Oil-Shale Kerogen, was adied for publication.

Although there were no retorting experiments during 1957, conlerable progress was made in studying the physical-chemical propies of calcined oil shale and converting the kerogen of oil shale by cterial action.

Laboratory work on the characterization and analysis of fractions oil from the N–T–U retort advanced, and similar work on oils from e entrained-solids retort was almost completed.

A spectrometric group devoted considerable time to determining types of nitrogen compounds in N–T–U gas oil and interpreting rogen spectra. Three papers concerning spectroscopy and shale oil re published during the year.

HELIUM

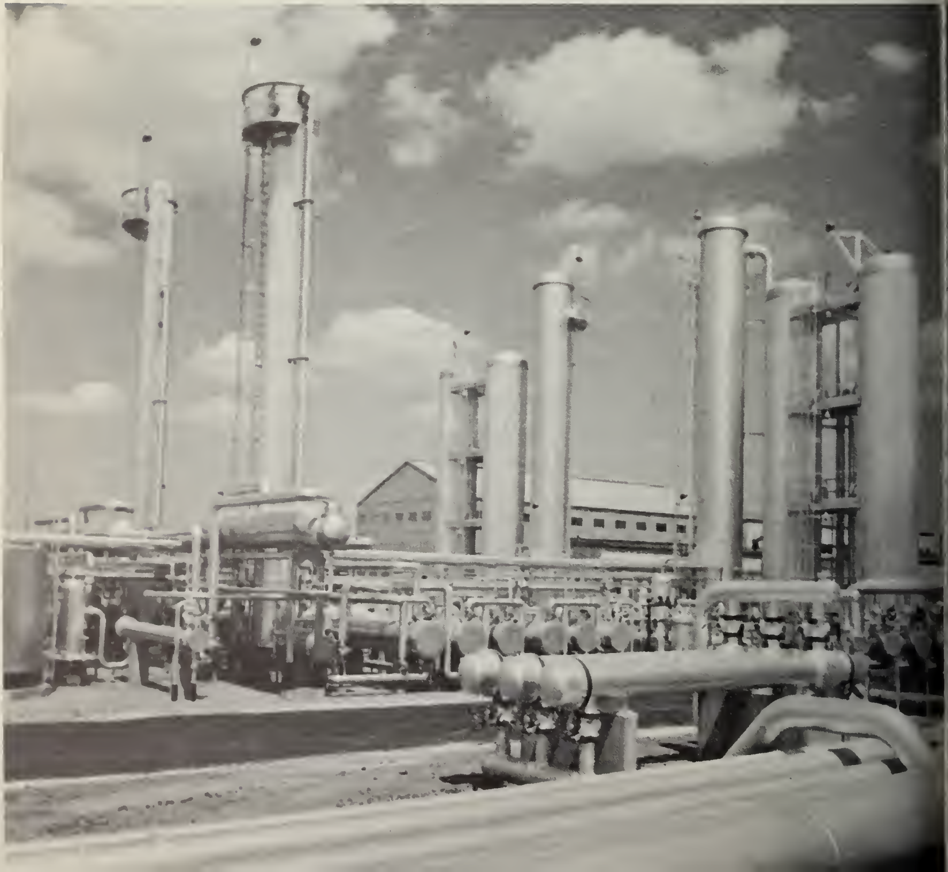
Production and shipment of helium by the Bureau of Mines estabed new records in 1957. Primary helium output reached a new k of 242,926,632 cubic feet, and shipments totaled 282,015,442

cubic feet. The difference between production and shipments w
made up by withdrawing and repurifying helium that had been pr
duced and then stored in the Cliffside field in previous years whe
output exceeded demand.

The Federal Government continued to use directly about 75 pe
cent of the helium produced by the Bureau of Mines, and most of th
remainder was employed by private industry on Federal defense co
tracts. Smaller, but important, quantities were consumed in ho
pitals and research.

Demands for helium continued to increase throughout the year, an
the Bureau was unable to meet all requirements, despite record pr
duction and shipments. It was necessary to return to an inform
allocation system early in the year to assure that the more importa
defense and medical needs were fulfilled in preference to less esse
tial balloon and advertising requirements. Federal and privat

FIGURE 20.—Part of the new construction at the Exell, Tex., helium plant
the Bureau of Mines is shown in this photograph. The expansion progra
at Exell was completed in fiscal year 1957.



ium users and private helium distributors cooperated with the Bu-
u of Mines in making this system work. Consequently, all defense
l medical requirements were met, but helium deliveries for non-
ense uses were curtailed.

The Bureau of Mines made considerable progress during the year
improving the helium supply-and-demand relationship.

A contract was awarded in September 1956 for building addi-
nal helium-production facilities at the Exell, Tex., plant. The
argement was virtually complete at year's end. The first new
ts, representing an additional capacity of about 50 million cubic
t annually, began operating June 2. This new capacity became
ilable too late to relieve the helium shortage in fiscal year 1957
presages major relief in 1958.

When the new Exell facilities become fully operative, they will
duce approximately 150 million cubic feet annually and thus raise
overall annual capacity at Exell to 240 million cubic feet. A fur-
r increase in capacity will come later through modernization and
ision of equipment in the old portion of the plant.

mprovements also were made at the Bureau's other helium plants.
e water system at the Navajo (Shiprock), N. Mex., plant was
nged substantially to assure a more reliable supply to sustain the
h level of production attained by processing helium-bearing gas
n the nearby Hogback field. At the Otis, Kans., plant, additional
um-bearing gas was made available for processing when the
ffer field was connected to the gas system supplying the plant.

lans advanced for designing and installing a new combination
um production-nitrogen removal unit at the Amarillo, Tex., plant.
s unit not only will add to the helium-production capacity but
will improve the heating value of residue gas from the plant.
present, the residue gas is salable only for use in a local smelter,
the output of the Amarillo plant is frequently affected by smelter
rations. During World War II it was necessary to waste some
he residue gas to the atmosphere to sustain the necessary high
l of helium production at Amarillo. The new unit will free the
nt from depending upon a single sales outlet for the residue gas.

ifteen additional railway helium tank cars were ordered for
very in September 1958. When these cars are received, the cars
e Government pool operated by the Bureau of Mines will total 122.

hese improvements and additions will enable the Bureau of Mines
andle the estimated helium requirements in the immediate future,
the growing helium demand is expected to exceed the capacity of
ting facilities before 1960. Consequently, the Bureau of Mines
inued its studies of the helium supply-and-demand relationship
a long-range viewpoint.

The wastage of large quantities of helium when unprocessed heliu bearing natural gas is consumed in fuel markets is a matter of i creasing concern. If this wastage continues unabated and heliu use increases as expected, the known helium resources of the Unit States will become inadequate to meet all demands beyond 1975– The Bureau of Mines is working with other interested agencies developing a long-range Government helium-conservation policy efforts to forestall this situation.

The Bureau of Mines continued to sample and analyze new natura gas occurences during the year to determine their helium conte No significant new sources of helium-bearing gas have been fou since 1943.

The Bureau also continued its modest research program aimed increasing the overall knowledge of the properties and characte istics of helium-bearing natural gases and methods of extracti helium from them. This work included a study of factors affecti hydrogen adsorptive capacities of activated charcoal and synthet silicates, and phase relationships, dewpoints, and compressibility fa tors of selected gases.

In another activity, the Bureau supplied technical advice and a praisal to the Navy and the Bureau of Standards in a study of t feasibility and cost of producing and shipping liquid helium; t Bureau expects to take a more active part during the 1958 fiscal yea

HEALTH AND SAFETY ACTIVITIES

The Bureau's activities for improving safety and health conditio in the mineral industries were modified to cope with rapidly changin methods, practices, and equipment.

Safety education and training programs continued to be emphasize as heretofore. More study and attention were provided for the speci problems of roof support, exposure to atmospheric dusts, fire and e plosion hazards in coal mines, and radioactive exposures. Investiga tions of other hazards were continued, with recommendations to elim inate them. By inspection of coal mines and enforcement of th Federal Coal Mine Safety Act, the Bureau endeavored to impro safety conditions, but two major disasters resulting in 42 fataliti occurred during the fiscal year.

Work on Primary Hazards

Roof falls caused 63 percent of the 1956 coal-mine fatalities compared with 58 percent in 1955. A new campaign was inaugurated in cooperation with other agencies, in efforts to bring this hazard uder better control. Such a concerted effort was effective in undergound noncoal mines in 1955, and its influence is still being felt.

Bolting continued to control coal-mine roofs effectively. Of 245 rof-fall fatalities in bituminous-coal mines in 1956, only 4 were attbuted to failure of bolted roof, compared with 6 in 1955, yet the ue of roof bolts had increased approximately 5 percent.

Laboratory and field studies were carried on by the Bureau to detmine the basic principles of mine-roof support and to increase the eectiveness of roof bolting. Efforts to systematize the use of compession pads and other warning devices, tests of new types of bolts, ad centrifugal studies of rock specimens continued.

Testing Equipment

The continually increasing mechanization of coal mines was reflected i the Bureau's mounting workload. Trends in mining methods were dscernible in analyzing the list of approved equipment. The change to cntinuous mining machines persisted with a resultant increase in the nmber of bridge or "piggyback" conveyors and elevating conveyors. The increased approvals by the Bureau of auger-type machines may idicate a swing to this type of equipment for low-coal mining.

The Bureau's approval schedules for fire-resistant conveyor belts ad for generalized mine lighting added considerably to work troughout the year. A photoflash unit and an explosion-proof floodliht were developed for underground photography.

Interest in diesel-operated equipment for noncoal mines prompted a seminar on diesel problems conducted by the Bureau in Denver, Clo., with representatives from 10 States and 3 foreign countries.

During the year 118 approvals and 145 extensions of approval were isued under 12 schedules. Approvals were granted for mining macines, loading machines, shuttle cars, pumps, wet rock dusters, compessors, fans, drilling machines, power units for mining machines, dtribution boxes, generalized lighting systems, diesel tractors with sovel, an electric shaft shovel, a dehumidifier, a splicebox, a pan tnsformer, a photoflash unit, a diesel traxcavator, and a 10-ton diesel lcomotive.

Flame-resistance tests were run on 20 cables and 62 conveyor belts; 1 belt was subjected to a friction test. Damage-resistance tests were rn on 8 cables, 3,095 explosion tests were made in natural gas-air mxtures, and 103 compartments were inspected and tested.

Seven drill-dust collectors for coal-mine use were approved, and 1 extensions of approval were granted. The Bureau's second Experimntal Coal Mine, the site of these dust-collector tests, was enlarged f other studies of dust and ventilation.

One new approval and 51 extensions of approval were granted f respiratory protective equipment, including gas masks, supplied-a respirators, dust respirators, and nonemergency gas respirators. Te equipment and tentative requirements for paint-spray respirato were prepared.

Insistent requests were made to the Bureau of Mines by users an manufacturers of respiratory protective devices to broaden its respirator-approval system to include radioactive aerosol respirators. Th Bureau agreed, and it will construct laboratory and office space fo the radioactive aerosol testing. An Advisory Committee on Respiratory Protection Against Radioactive Materials was formed, to consult with personnel of the Bureau of Mines on developing requirements for testing and approval. Membership of this committe includes representatives of the Atomic Energy Commission, Atomi Energy Commission Contractors, Industrial Hygiene Foundatio Industrial Medical Association, Industrial Safety Equipment Association, and the United States Public Health Service.

Health

The Bureau's program to promote more healthful working conditions in the mineral industries emphasized studies of hazards that ma be created by modern technology.

Upon request of the Committee on Education and Labor, House o Representatives, testimony was presented on bills regarding health and safety inspections and investigations in metallic and nonmetallic mines and quarries. Discussions continued with the United States Public Health Service regarding a much-needed study to determine pulmonary disability among American coal miners. Tentative plans also were formulated to study radioactive exposures in uranium mines; to investigate silicosis hazards in metal mines; and to conduct research on effectiveness of respiratory protective equipment against the newly developed and highly toxic materials now being used in increasing amounts in industrial and military operations.

During the year 19,046 gas samples were analyzed, including 18,097 taken during Federal coal-mine inspections. Others came from sealed fire areas in coal mines, metal and salt mines, tunnels under construction, tests of diesel-powered equipment in underground use, tests of respiratory protective equipment, and miscellaneous field and laboratory studies.

Field studies of diesel equipment were carried on in several mines and tunnels. Experiments were made to find fire-resistant substitutes for flammable petroleum hydraulic fluids commonly used in mining machines.

Possible hazards from mineral dusts were assessed by X-ray difraction and spectrographic methods. More than 550 samples of air-orne dust were examined to determine concentration and particle size. ust-sampling equipment safe for use in gassy mines was developed, nd 10 persons were trained in the sampling, counting, and sizing of ir-borne dusts. On request, the Bureau conducted periodic dust and entilation surveys during construction of the Genesee Tunnel projt in Connecticut.

Ventilation surveys by the absolute pressure method were made in hree mines to demonstrate the advantages of this method. These eld data were analyzed with the Bureau's electric analogue, which ontinued to arouse interest, being demonstrated to 54 engineers durg the year. Particular attention was given to studies of ventilation coal mines using continuous-type mining machines and to the feasility of ventilating coal mines without using doors.

Future programs include studies of exposure of workers to dusts a representative segment of the coal-mining industry, of dust-ontrol practices in metal mining and tunneling, of dust production d control on continuous-type coal-mining machines, of air condioning in deep, hot mines and heat-tolerance and the concept of efective temperature in respect to mining, of the type of airflow—hether streamline or turbulent—and resistance factors in coal mines.

afety Education

Experience of the Bureau has shown the value of safety training ourses in reducing accident rates, partly by promoting safety coniousness but more so by giving officials and workmen the advantage research findings on hazards and ways of guarding against them. he Bureau intensified production of motion pictures to be used in fety-training classes during the past year.

In round numbers, 17,000 persons completed the Bureau's accident-evention course for coal miners and supervisors, raising the number ained since 1947 to 195,000. Records prove that the greatest imovement in accident rates at mines comes when every official and orkman has taken this course. Thus, the Bureau placed additional nphasis on 100-percent participation. Bureau personnel continued give similar accident-prevention courses at mines and plants in her branches of the mineral industries.

By the end of the fiscal year, 1,912,000 persons had taken the ureau's first-aid course, and 109,700 had taken its mine rescue course nce 1910. The Bureau stimulates interest in these activities by ponsoring and contributing judges and other officials to local, State, d national contests and by sponsoring the Holmes Safety Associaon, a national organization whose local councils and chapters provide excellent forums for duscussing the causes of accidents and wa of preventing recurrences.

Bureau representatives investigated dust explosions in industri plants and assisted in preparing codes and standards designed prevent such explosions.

Accident Analysis

Analysis and tabulation of injury and related employment recor continued as useful guides for developing better programs to preve accidents in the mineral industries. In addition to the regular indu try reports, special tabulations were prepared for State and Feder agencies, trade associations, labor unions, and others.

Industries covered included coal mining, coke production, quarr ing, metal and nonmetallic mining, metallurgical operations, and p troleum and natural-gas production and refining. A revised for used for the first time to classify and tabulate causes of injuri in the metal- and nonmetallic-mining industries, will enable th Bureau to compile severity as well as frequency rates for them.

The 32d National Safety Competition and four other safety co tests were conducted by the Bureau; approximately 1,500 mine quarries, and plants participated. Some 2,000 certificates of accom plishment in safety were presented to workmen and supervisors a winning plants.

Control of Fires in Inactive Coal Deposits

At the end of the fiscal year, the Bureau had controlled or wa combating 63 of the 190 known fires in coal deposits not now bein mined, 36 on the public domain and 27 on private property. Coa reserves conserved under this program since the Congress first appro priated funds for it in fiscal year 1949 now total an estimated 26 million tons.

Eight fire-control projects were completed in fiscal year 1957, fiv on the public domain and three on private property, and work proceeded on eight others.

Future plans include necessary maintenance work on completed projects and the start of new ones, in order of urgency, to the extent appropriations permit. The Government pays the full cost of controlling fires on Federal land and requires local contribution of half the cost of controlling those on private property.

Coal-Mine Inspection

For the fifth full year coal-mine inspection work was carried on under the Federal Coal-Mine Safety Act. Besides title I, authorizng the Bureau to enter and inspect coal mines, report on hazards, and ecommend (but not require) their correction, it includes in title II pecific enforcement provisions designed to prevent explosions, fires, undations, and man-trip and man-hoist accidents in mines regurly employing 15 or more men underground.

The Nation had approximately 9,458 active coal mines in 1956, ncluding 1,541 title II mines (more than 14 underground employees), 693 title I underground mines (14 or fewer underground emloyees), and 1,224 strip mines. At the end of fiscal 1957 Bureau ersonnel assigned to coal-mine inspecion and related duties included 53 coal-mine inspectors, 23 engineers, and 9 coal-mine inspectors electrical).

During the year 3,507 regular inspections were made of coal mines ubject to title II, 38 of them jointly with State inspectors under tate-Bureau cooperative agreements provided in the act. In addion, 1,336 inspections were made to determine whether previously ted violations of mandatory provisions had been abated.

Federal inspectors observed 8,998 violations of the mandatory prosions, many of which were corrected immediately and thus required o formal action. They issued 1,414 notices setting a reasonable time r abating dangers, 375 granting time extensions, and 1,300 certifying at dangers had been totally abated.

During the year 83 orders were issued requiring withdrawal of men om all or part of 57 mines—54 orders at 43 mines because of immient danger and 29 at 15 mines because of failure to abate violations ithin a reasonable time. By comparison, 112 withdrawal orders ere issued at 63 mines during the previous year.

Orders were issued classifying as gassy eight mines previously condered nongassy. The Federal Coal-Mine Safety Board of Review, n independent agency, denied one appeal by an operator for annulent of a gassy-classification order and revised another order to apply nly to that section of the mine in which methane (explosive gas) as detected. The former was appealed by the operator to the United tates Court of Appeals, but the appeal was denied.

Federal inspectors and engineers also made 7,331 inspections of naller title I mines (including 875 strip mines), 554 electrical, venlation, dust, blasting, and related surveys, and 670 investigations of tal and serious nonfatal accidents, mine fires, gas and dust ignitions, nd miscellaneous conditions.

Two major explosion disasters (1 causing 5 deaths, the other 37) ccurred during the fiscal year. The first of these, in January 1957, roke a 26-month disaster-free period in the domestic coal-mining dustry. Preliminary reports show 444 coal-mine fatalities in calndar year 1956, compared with 417 in 1955; the fatality-frequency rate per million man-hours exposure also increased from 1.04 in 19 to 1.08 in 1956.

FOREIGN ACTIVITIES

In the 1957 fiscal year the Bureau intensified its foreign activiti on projects and services designed to assure a continued inflow strategic and critical minerals needed to fill the gap between domest production and consumption and to provide a reserve stock adequa for sustaining a possible emergency shortage. In collecting informa tion for this and other uses of the Department, the Bureau's liaiso office processed and distributed more than 31,000 foreign service di patches from the Department of State. Those pertinent to the pr gram were combined with technical and economic information fro other sources, evaluated, and analyzed.

Within staff limitations, information on foreign mineral resource exploration, investments, controls, development, production, process ing, transportation, consumption, marketing, and international trad was widely distributed. One foreign government requested and re ceived guidance in drafting its natural resources law governing min erals and hydrocarbons and designed to attract the investment o national and foreign private capital on reasonable and equitable terms

The Bureau also gave technical aid to underdeveloped countrie and advanced training to foreign specialists. These activities hav strengthened our sources of essential mineral supplies and contribute to expansion and protection of investment by private America capital in developing foreign mineral resources.

Services to Government and Industry

Requests relating to foreign mineral matters from Federal agencies, foreign governments, consultants, educational and research institutions, and companies seeking new investments in the foreign minerals field and new markets for machinery and equipment were answered by publications of the Bureau, 1,116 personal interviews, 1,965 letters, and 2,123 telephone calls, in addition to the preparation of detailed special purpose reports. The Bureau cooperated with the Department of State in appraising and improving foreign service reporting.

The year was notable for the intensive exploration activity of mining and petroleum companies, particularly in Latin America, Canada, Africa, and Australia, in search of new mineral resources in general, but with special emphasis on petroleum, bauxite, iron ore, nickel, manganese, chromite, and rutile. This is normal to the rapid expansion of American investment in developing mineral industries abroad.

echnical Assistance

The Bureau maintained its program of technical assistance roughout the year under its continuing agreement with the Interational Cooperation Administration, with engineers assigned to 17 rojects in 13 countries: Afghanistan (2), Brazil, Colombia, Cuba, gypt, Israel (2), Indonesia, Liberia, Mexico, Nepal, Pakistan (2), eru, and the Republic of the Philippines (2). The projects inluded 5 in metallurgy, 4 in coal mining and technology, 5 in metal nd nonmetal mining, 1 of combined responsibilities, 1 in chemical ngineering, and 1 as an adviser in the proposed establishment of a overnment mining agency. Three projects were terminated during e year, 2 were interrupted by the Suez crisis, and 2 were newly arted.

The educational program inaugurated last year, utilizing Bureau otion pictures depicting safety practices and various mining and etallurgical operations continued successfully.

A metallurgical project in Mexico was supplemented by assignment f a two-man Bureau team for 4 months of instruction to miners and anagers at several mining centers in first-aid and mine rescue ractices. A Bureau metallurgist assigned to Peru, in addition to is regular duties, campaigned successfully for establishment of a etallurgical department at the National University of Engineering.

Under the technical assistance program, research was conducted Bureau field stations at Albany, Oreg., on the production of ferrockel from Philippine laterites and serpentines; at Denver, Colo., designing and constructing a pilot plant to be installed at Neyveli, dia, for drying, briquetting, and carbonizing lignite; and at College ark, Md., on the metallurgical treatment of copper ores from Sinhao, Peru.

oreign Trainees

Training of mineral technologists from abroad at Bureau laboraries increased one-third over fiscal 1956. Of the 36 technologists ceiving training, 28 completed their assigned studies, and 8 reained at the end of the year. The trainees came from 14 countries: fghanistan, Formosa, Greece, India, Indonesia, Iran, Iraq, Kenya, orea, Mexico, Peru, the Republic of the Philippines, Thailand, and ugoslavia. Training emphasis, accorded to the major needs of the untries represented, was on mining and metallurgy, the production d efficient utilization of fuels, and health and safety practices. The ureau estimates it will accommodate about 35 foreign trainees durg the 1958 field year.

RIVER BASIN ACTIVITIES

Water-supply and drainage-control problems of the Nation continued to increase daily in number and complexity during the year lending additional importance to the activity and cooperation amon Federal, State, and private agencies to seek their solution and to promote water conservation. Problems regarding inundation of minera resources, pollution, water supply, and mine drainage were of increasing concern to the Bureau.

Mine-drainage and flood-protection problems in the Susquehanna Basin, especially in the Pennsylvania anthracite area, were studied in cooperation with the Commonwealth of Pennsylvania and the United States Corps of Engineers.

Special reports were prepared concerning the mineral industry in proposed Federal and non-Federal water-development project areas. The Bureau supplied professional mineral-engineering consulting services on preparation of the United States Department of Agriculture's Interim Watershed Protection Handbook; a possible corridor for Canada to a free port through southeastern Alaska; minerals in small watershed developments; and minerals in or near proposed reservoir sites. In the last category, where significant mineral deposits faced inundation and cessation of production, economic means were found to provide both continued mineral production and water conservation.

During the year investigations and reviews of reports for other Federal agencies included 32 for the Corps of Engineers, 31 for the Federal Power Commission, 6 for the Bureau of Reclamation, and 18 for the Department of Agriculture.

Missouri Basin Project

Using special funds appropriated annually for the Missouri Basin program, the Bureau of Mines completed three technical reports for Federal and State agencies, covering several phases of the mineral industry and its relation to water conservation and development. Fourteen proposed reservoir sites were examined and reported on for the Bureau of Reclamation. At the Oregon Basin site, where inundation of oil wells was involved, engineering recommendations were made for appropriate installation of causeways and dikes to permit continued petroleum production, coincident with operation of the proposed reservoir.

Metallic- and nonmetallic-mineral studies concerned source investigations, utilization, and industrial feasibility. Part I of a two-part report on the phosphate industry of Montana was released to the cooperating agencies for use in planning work. Several manuscripts involving mineral raw materials for various industries were being prepared at year's end. A study was begun in cooperation with the Bureau of Reclamation on properties of various clays that might be used to reduce the cost of lining canals and increase their efficiency.

Studies of pegmatites in the Black Hills of South Dakota were completed, and a report was scheduled for early release.

MINERAL ECONOMICS

Providing a background for developing long-range and mobilization mineral policies of the Federal Government, the Bureau made statistical analyses of many mineral commodities to estimate the quantitative effects of alternative Government policies affecting mineral industries.

Supply-and-demand responses to changes in prices, gross national product, industrial production, relative prices of substitutes, stocks, investment, and to technologic developments were statistically evaluated for the United States and other countries., More than 100 demand situations for fuels were analyzed.

The cost to taxpayers, consumers, and related industries and probable benefits to the mining and metallurgical industries were determined for tungsten, fluorspar, asbestos, and columbium-tantalum, purchasable by the Federal Government under Public Law 733 (84th Cong).

An analysis of the energy sector of the national economy was undertaken to update an earlier Bureau of Mines study. The latest analysis was a comprehensive study of energy flows from energy-producing industries to all energy-consuming industries, based upon the 1954 Census of Manufactures and Census of Mineral Industries. The information was used to organize an interindustry model of energy flows to give for the first time, a complete and balanced picture of the energy sector of the economy.

Foreign trade patterns, tariff and quantitative restrictions on mineral commodities, and other pertinent factors were analyzed in connection with negotiations under the General Agreement on Tariffs and Trade. The effects on United States and foreign prices, outputs and consumption of proposed tariff changes, and barter goals for individual mineral commodities were studied. The overall situation of imports and exports and various Government actions and transportation cost changes as they affected the trade position of mineral industries were under continuing analysis and review during the year.

The effects of Federal and State taxation on mineral enterprises and their finances continued to be studied. Estimates were made of benefits received under the Federal programs of accelerated tax amortization. To estimate the effects of proposed changes in mineral-taxation laws, studies of the profitability of the mining industry, using income-tax data as the primary source, were prepared.

PUBLIC REPORTS

In carrying out the Bureau's responsibility of making its finding widely available, 595 manuscripts were prepared for publicatio during the fiscal year. They included 7 bulletins, 193 chapters and bound volumes of the Minerals Yearbook, 1 miners' circular, 1 handbook, 87 reports of investigations, 35 information circulars, 21 speeches and journal articles, and 58 miscellaneous reports. Thei preparation involved writing and editing more than 26,000 pages o text.

Showings of films from the Bureau's free loan library of industry sponsored technical-educational motion pictures totaled 239,020, a alltime high, reflecting increasing demand, particularly from school in the 48 States, Alaska, Hawaii, and the District of Columbia. Recorded attendance at group showings was 14,052,929, and an estimated additional 36.5 million persons saw the films on noncommercia television programs.

Three of the Bureau's motion pictures received awards for excellence during the year at film festivals in the United States and abroad.

During the year two new film subjects were added to the Bureau's library, The Petrified River—the Story of Uranium, and Idaho and Its Natural Resources. At year's end 6,297 prints were on deposit at Pittsburgh, Pa., and at cooperating subdistributing centers throughout the country, a net gain of 116, but the demand for prints continued to exceed the supply.

ADMINISTRATION SUMMARY

Continuous analyses of management practices and procedures resulted in strengthening the Bureau's ability to conduct expanding programs designed to contribute to the national security and well-being.

An Office of Management Analysis was organized to give staff assistance to the Deputy Director in general management of the Bureau; in programing plans of action and providing the leadership for bureauwide management improvements; and stimulating participation in and coordinating management-improvement projects at all levels of operation.

Organization and Management

A new Health and Safety district office was established at Norton, Va., to relieve the workload of District C, headquartered at Mount Hope, W. Va. Coal production in District C, 1 of 8 Health nd Safety districts before the organizational change, represented bout 50 percent of the Nation's total. About 40 percent of the Fedral coal-mine inspectors and engineers had been assigned to istrict C.

A committee composed of representatives of the Office of the Secetary and the Bureau was established to review management pracices bearing upon organizational effectiveness. In addition, the Diector appointed a committee to review and recommend procedures oncerning the production and distribution of publications and the istribution of motion pictures. Reports from these committees will e considered for action in the 1958 fiscal year.

A Bureau representative was appointed to serve on the Departental Automatic Data-Processing Committee.

Substantial progress was made toward completing the Bureau of ines Manual.

The use of administrative orders and business orders for releasing ureauwide continuing instructions was discontinued.

roperty

During the year efforts were concentrated on reducing the invenories of excess property at various field installations to a minimum. his resulted in redistribution of valuable equipment and supplies to oints of greatest need and has become a continuing process of culling nused items and circularizing all other Bureau activities so as to place em where they may be needed most.

Progress was counted in reducing expendable materials in formal orerooms throughout the Bureau. As a result, numerous slowoving items were eliminated from stock, with satisfactory reducons in the overall inventories.

The number of locations of imprest fund cashiers was increased rom 19 to 26. This increase, plus the expanded use of monthly arge accounts, enabled the Bureau to reduce substantially the numer of purchase orders.

Simplified procedures for property accounting were prepared in anual form and were distributed to employees. At year's end aditional Manual revisions were being prepared for early publication.

inance

During fiscal year 1957 reports were completed and submitted on surveys made during fiscal year 1956 regarding 2 aspects of finanal operations in the Bureau.

The report on the survey of the accounting system recognized seval problems concerning operating personnel, and recommendations were made that will facilitate management of the Bureau's financia affairs.

Information gained from a bureauwide study of practices at fiel installations in the use and cost of common services, such as shops, an the methods employed in distributing these costs and administrativ expenses, will prove beneficial when recommendations in the repor are put into operation.

The Branch of Finance participated in studies on problems concerning the processing of Bureau publications and distribution of motio pictures.

Bureau of Mines funds, including direct appropriations, prior balances available, reimbursements, advances and transfers from othe Government agencies, proceeds from helium operations, and contributions from non-Government sources, totaled $52,560,428. Of thi amount, $35,376,261 was obligated, leaving an unobligated balance o $17,184,167. Approximately half of this was represented by available-until-spent funds approved by Congress for the anthracite mine-drainage program. A recapitulation at the end of the following tabulation shows the approximate amounts and sources of unobligate balances.

Funds available to the Bureau of Mines for fiscal year 1957, by source of funds

Direct appropriation	$22,197,050
Prior year balance available	17,952,732
Expired funds available for disbursement	106,804
Less transfers and returns	—99,653
Reimbursement from other Government agencies	357,700
Advances and transfers from other Government agencies	5,662,854
Proceeds from helium operations	5,489,540
Contributions to trust funds from non-Government sources	893,401
Total	52,560,428

Obligations incurred by the Bureau of Mines in the fiscal year 1957, by appropriation

Conservation and development of mineral resources	$16,176,021
Health and safety	5,288,181
Construction	2,424,824
General administrative expenses	1,013,507
Anthracite mine drainage	328,645
Consolidated working funds	2,808,642
Appropriation transfers	2,299,098
Economic and technical assistance, defense support, Asia and Pacific, other than Formosa and associated States of Cambodia, Laos and Vietnam, executive (transfer to Interior)	410,685
Technical cooperative, general, executive (transfer to Interior)	170,096
Mutual defense financing, defense support, finance and technical assistance, Europe, executive (transfer to Interior) April 4, 1948–54	—274
Defense support, Asia (transfer to Interior)	44,872

Defense support, Near East, Africa, and South Asia, executive (transfer to Interior) 1955	—$2,985
Southeast Asia and Western Pacific, executive (transfer to Interior) 1955	—295
Technical assistance to American Republics and non-self-governing territories of Western Hemisphere, executive (transfer to Interior)	—161
Technical cooperation, general, executive (transfer to Interior)	81,914
Administrative expenses, section 411, Mutual Security Act, executive (transfer to Interior)	21,140
Development and operation of helium properties	3,438,648
Contributed funds	873,703
Total obligations incurred	35,376,261

RECAPITULATION

Total funds available to Bureau of Mines	$52,560,428
Obligations incurred	35,376,261
Unobligated balance of funds	17,184,167
Anthracite mine drainage	8,171,355
Construction 14X0954	1,243,835
Construction for Army	1,896,770
Helium balance	4,303,296
Balance available in fiscal year 1958	730,235
Balance under fiscal year funds not available	838,676
Total	17,184,167

Personnel

Manual.—Ten chapters of the Personnel portion of the Adminisrative Series of the Bureau of Mines Manual were issued covering policies and procedural instructions in these fields: Staffing, employee development, appeals, compensation for injury, social security, etirement, program evaluation, and employee health and safety.

Development of Employees.—The Bureau continued to participate n the departmental management training program. Secretaries, stenographers, and typists received training on preparing correspondence, manuscripts, and other communication mediums. A bureauwide training and promotion agreement for student trainees was written and was approved by the Civil Service Commission. It provides a uniform bureauwide plan for on-the-job training for student employees in engineering and science.

First-aid training on a voluntary basis was provided Washington office employees.

Staffing.—The Branch assisted in preparing a Bureau of Mines recruiting brochure. A statement containing general information on employment was printed for distribution among applicants. The

Bureau's promotion and in-service placement program went into effect in February.

The Personnel Branch participated in a program to give Explorer Boy Scouts information concerning engineering and scientific career opportunities.

A new examination for commodity industry analyst (minerals), grades GS–5 through GS–12, was prepared and was announced April 2, by the Bureau of Mines Board of United States Civil Service Examiners.

Safety.—The Bureau was awarded the Department's Green Cross emblem for the greatest improvement in employee safety for October, November, and December 1956 and January and February 1957. Although final figures were not available the Bureau estimated that its disabling-injury frequency rate for fiscal year 1957 probably will be lower than in 1956. A Bureau group was named to recommend policy and procedures for protection against radiation.

Employee Relations.—The Personnel Office cooperated with various committees, Bureau, departmental, and governmentwide, in coordinating and improving the Government's employee-relations programs. The revised Bureau of Mines Employees Handbook was given all employees during the year. A program was established to give emblems to employees with 10, 20, and 30 years of Government service.

Classification.—Reviews, field surveys, conferences, and discussions were held with employees to assure compliance with job-classification requirements. New standards for coal-mine inspector positions were prepared and were submitted to the Civil Service Commission. Surveys were conducted throughout the Bureau's largest health and safety district, and five field stations were visited.

Performance Ratings.—The Whitten amendment review of positions was combined on a trial basis with the performance-rating employee interview requirements of the Department's performance-rating plan. If it proves efficient and practical, the procedure will become bureauwide.

Interbureau Conference.—The branch participated in arranging and conducting the Interbureau Conferences on Career Service in the Department of the Interior in Portland, Oreg., Denver, Colo., and Washington, D. C.

Schedule and number of paid employees

	GS	Ungraded	Total
Departmental	612		612
Field	2,931	1,061	3,992
Total	3,543	1,061	4,604

Incentive Awards.—Activity in the incentive awards program almost doubled during fiscal year 1957. Following is a summary:

Suggestions received during the year	971
Suggestions receiving awards	320
Total of cash awards granted	$8, 520
Suggestions resulting in estimated annual savings	58
Suggestions resulting in intangible savings	262
Total estimated annual savings	$63, 484
Awards based on superior performance	57
Total cash awards granted for superior performance	$16, 464
Special acts or service awards	3
Total of cash awards granted for special acts or service	$1, 300
Total honorary awards granted	38

OFFICE OF OIL AND GAS

Hugh A. Stewart, *Director*

IN LESS THAN 10 years, there have been two major petroleum crises. The first emergency occurred during the spring of 1951 upon the shutdown of one of the world's largest refineries at Abadan in Iran. The second crisis involved the closing of the Suez Canal and the disruption of certain Middle East pipelines, which occurred during this fiscal year.

In the recent crisis, the Office of Oil and Gas exercised leadership in the formulation and effectuation of measures to protect the security and defense interests and programs of the United States as hereinafter described.

THE MIDDLE EAST PETROLEUM EMERGENCY

On July 26, 1956, the Government of Egypt nationalized the Suez Canal through which approximately 1,478,000 barrels of petroleum were transported every day for use of friendly foreign nations in the Eastern Hemisphere west of Suez. In the circumstances, it became necessary promptly to consider the possibility of a serious interruption in the flow of petroleum through the canal and the pipelines in the Middle East. Because of the effect which such an interruption would have upon the Western Free World, including those nations allied with the United States in the NATO, on August 1, 1956, the Secretary of the Interior, at the suggestion of the Director of the Office of Defense Mobilization, declared that an emergency existed which required the preparation of a plan of action under the Voluntary Agreement Relating to Foreign Petroleum Supply, as amended May 8, 1956. The plan was to be one for the prevention, elimination, or alleviation of shortages in petroleum supplies which would threaten to affect adversely the defense mobilization interests or programs of the United States.

Developments in the Middle East situation culminated in the closure of the Suez Canal, on October 31, 1956, and the disruption in Syria, on November 3, 1956, of the petroleum pipeline from Iraq carrying some 544,000 barrels of oil per day. Thus, the Middle East petroleum transport stoppage, which threatened in late July and materialized at the beginning of November, involved over 2 million barrels of petroleum per day, or nearly two-thirds of the normal requirements, approximately 3,250,000 barrels per day, of the West of Suez areas affected.

Following the Secretary's action on August 1, the chairman of the Foreign Petroleum Supply Committee immediately initiated the necessary action for preparation of a "plan." Pursuant to call of the chairman, the Foreign Petroleum Supply Committee met on August 7, 1956, and prepared a "plan" which it submitted on the same day to the Secretary of the Interior. After review and modification, the "plan" was submitted by the Acting Secretary of the Interior to the Director of the Office of Defense Mobilization for his approval, and for the approval by the Attorney General of the request to designated American oil companies engaged in foreign operations to participate in it.

After several conferences, involving the Office of Defense Mobilization, Department of Justice, and Department of the Interior, at which additional revisions were made, the plan of action to deal with the Middle East petroleum emergency was promulgated on August 10, 1956. Sixteen oil companies became participants and members of the Middle East Emergency Committee established by the plan. One other oil company, a subsidiary of one of the participants, became a participant but not a member of the Committee.

Plan of Action

The fundamental objectives of the plan of action were the formulation and effectuation of measures to offset or minimize petroleum shortages and dislocations in friendly foreign areas which might be brought about by a Middle East petroleum transport stoppage. To attain these objectives, the plan provided for the establishment of the Middle East Emergency Committee composed of American oil companies having, in the aggregate, petroleum operations extending throughout the Free World. It also provided for the establishment of subcommittees to assist the Middle East Emergency Committee in its assignments.

Seven such subcommittees were appointed by the Administrator as follows: Supply and Distribution Subcommittee, Tanker Transportation Subcommittee, Production Subcommittee, Refining Subcommittee, Pipeline Transportation Subcommittee, Statistical Subcommit and Information Subcommittee.

Substantially, the plan of action authorized the Middle East Em gency Committee and its subcommittees to engage in only two typ of activities: (1) at the request of the Administrator or the Direct (an official of the Office of Oil and Gas appointed by the Administ tor), to prepare and furnish to the Government information and da essential to the development of measures to offset shortages resulti from a Middle East petroleum transport stoppage, and (2) to pr pare schedules of actions to be taken by the participants and othe to meet such shortages.

Activities of the Middle East Emergency Committee

The activities of the Middle East Emergency Committee and i subcommittees fell into three phases. The first phase extended fro August 24, 1956, the date of the first meeting, to December 3, 195 The second phase covered the period from December 3, 1956, whe the Middle East Emergency Committee was requested by Governme to begin the preparation of schedules and the taking of actions alleviate petroleum shortages resulting from the stoppage of the Su Canal and the Iraq Petroleum Co. pipeline, to April 18, 1957. Th third phase extended from April 18, 1957, the date as of which th Administrator suspended all existing schedules, to June 30, 1957, th end of all active operations.

During the first phase, August 24, 1956 to December 3, 1956, th Middle East Emergency Committee and its subcommittees were engaged exclusively in the preparation of information and data concerning foreign petroleum operations as requested by the Administrato or the Director. Such preparation comprised the gathering, analyzing, and evaluating of pertinent information and data covering th whole range of foreign petroleum activities, including productio refining, transportation, particularly tanker and pipeline transportation, supply and distribution, stocks and inventories.

In the first phase, the Middle East Emergency Committee and it subcommittees met on an average of three or four times a week Some 146 technical experts from the member companies served o the various committees. The meetings were supervised by representatives from the Office of Oil and Gas, two of whom were assigne on a full-time basis, and were attended by many representatives o other governmental agencies, particularly the Office of Defense Mobilization, Department of State, Department of Defense, and Department of Justice, as well as by high officials of the Department of th Interior.

The second phase, extending from early December 1956 to around e middle of April 1957, covered the critical period of the Middle ast petroleum crisis. The most important problems arose and were lved during this period. Practically all the actions devised by the ommittee, and reflected in schedules, to offset the supply shortages the Eastern Hemisphere west of Suez were taken during the second hase which began on December 3, 1956. Effective December 3, 1956, e plan of action was amended to provide greater flexibility and effi- ency in the operations of the Committee and the participants under e plan. Five schedules of action and three amending schedules ere prepared by the Committee and recommended to the Secretary f the Interior as Administrator of the agreement during this phase. our schedules and two amending schedules were approved and issued y the Administrator. These schedules and amendments originally ad a termination date of March 31, 1957. Some were extended to ay 31, 1957. In addition to preparing schedules, the Committee ntinued throughout the second phase, to gather, evaluate and keep urrent pertinent information on all aspects of foreign petroleum perations.

Both the Government and the Middle East Emergency Committee ept the schedules and the actions taken pursuant thereto under con- nuous review. For this purpose, the Administrator established the lan of Action Review Committee comprised of representatives from e Office of Defense Mobilization and the Departments of State, efense, Justice, and Interior. The Supply and Distribution Sub- mmittee made a semimonthly analysis of actions taken under sched- les and offered suggestions as to the more effective implementation ereof.

During the second phase, the Middle East Emergency Committee nd its subcommittees held 40 meetings, consisting of 54 daily sessions, n average of approximately three meetings a week over the entire eriod. Some 178 technical experts from the member companies rved on the various committees. The same Government supervision nd attendance took place as in the first phase.

The third phase began when the Administrator suspended all sched- les on April 18, 1957. It extended through June 30, 1957, after hich no active operations were contemplated. During this phase, e activities of the Committee and its subcommittees were confined the preparation of data and reports to keep the Administrator in- rmed as to the status of supply positions in the affected foreign reas and to the completion of the historical record of petroleum ovements from the time of the stoppage in early November until the esulting shortages were substantially overcome in the second quarter f 1957. Supervision by Office of Oil and Gas representatives continued without let-up during this phase, but attendance by oth agencies diminished.

Cooperation with Foreign Agencies and Committees

It was recognized by the Government, based on experience duri the Iranian petroleum crisis of 1951–1952, that, in the event of sto page of the Suez Canal and any of the Middle East pipelines, the would have to be cooperation and coordination between the Midd East Emergency Committee, its subcommittees and the participan in the plan of action, on the one hand, and foreign industry commi tees, and possibly governmental agencies, particularly in Europe, c the other. Such relationship was specifically authorized by the pla of action, and urgently recommended by the Department of Stat Accordingly, the Administrator designated, in succession, the fo lowing foreign groups with which the Middle East Emergency Com mittee, its subcommittees and the participants should cooperate an coordinate their activities: the British Oil Supply Advisory Com mittee, made up of representatives of British and Dutch oil companie the Oil Emergency London Advisory Committee, made up of repre sentatives of British, Dutch and French oil companies, and finall the Organization for European Economic Cooperation and its O Committee, made up of representatives of 17 European government as well as a foreign industry advisory committee, known as the Or ganization for European Economic Cooperation Petroleum Emer gency Group, which was set up by OEEC.

These foreign groups were concerned with the Middle East petro leum crisis from the European viewpoint. Their representative participated in all the meetings of the Middle East Emergency Com mittee and its subcommittees and furnished information and data i the same manner as did the members of these committees. Similarly representatives abroad of some of the members of the Middle Eas Emergency Committee attended meetings of the foreign industr committees and furnished pertinent information and data to them The American companies were required to render a full account o such coordination and cooperation in periodic reports which wer transmitted by the Administrator to the Attorney General. Suc participation did not include allocation of supplies among the variou European countries. This was handled by the foreign government through the Organization for European Economic Cooperation Oi Committee. The cooperation between the Middle East Emergency Committee and their foreign counterparts proved very effective and was one of the principal reasons for the successful solution of the Middle East petroleum emergency.

ermination of Plan of Action

In the light of the satisfactory supply position in the second quarter 957 as estimated by the Middle East Emergency Committee, and in iew of the reopening of the Suez Canal to tanker movements, the ecretary of the Interior, in his capacity as Administrator of the greement, on June 29, 1957, determined that the activities of the iddle East Emergency Committee should be suspended, and that, the absence of any material change in the situation, the plan of tion should be terminated and the Committee disbanded as of July 1, 1957.

esults and Accomplishments of Program

The outstanding success of the program is shown by the following cts: During the period of the actual emergency, generally from ovember 1, 1956, through March 31, 1957, an average of 3,007,000 rrels per day of petroleum, or 90 percent of the normally required pplies of 3,250,000 barrels per day (which included not only daily nsumption demand but normal seasonal inventory buildup), were ade available to the affected areas. As a result, there was no disrup- on, at any time, in the economic life of any of the affected areas be- use of lack of petroleum supplies. Thus, the sole objective of the rogram, namely, to prevent a substantial petroleum supply shortage friendly foreign areas, was attained.

In the success of the program, the Middle East Emergency Com- ittee and its members, aided immeasurably by representatives of the reign committees, played the major role. Others who contributed tally to the successful outcome were the State regulatory agencies, aribbean governments and the many oil companies, which made the rge quantities of essential supplies available from the Western emisphere, and United States Government agencies, particularly e Coast Guard and the Military Sea Transport Service, which were sponsible for making additional tanker capacity available.

TANKER FLEET STATUS AND OUTLOOK

Nationalization of the Suez Canal and subsequent events made it esirable for Government in its emergency planning to focus atten- on and study on the status and outlook of the worldwide tanker eet. Faced with the possibility of a shortage of tankers in the pe- oleum trade, it appeared necessary that a review be made of the pres- t and future status of the tanker fleet. Government agencies with sponsibilities in connection with tanker transportation reviewed d summarized information available in Government.

President Dwight D. Eisenhower by memorandum, dated Octob 12, 1956, to the Director of the Office of Defense Mobilization directe him to take steps immediately to bring together representatives of tl National Petroleum Council to meet with the Secretaries of Stat Treasury, Defense, Commerce, and Interior to consider plans to a sure the efficiency and adequacy of the distribution of petroleum su plies in the foreseeable future in the Free World.

It was stated that the plans should, so far as the interests of th United States are thereby served, provide for the building in Unite States shipyards of a sufficient number of large tankers to help supplement existing means of distribution and, if necessary, to help serve a an alternative in the transportation of oil in the Free World, particularly from the Middle East.

The Director of the Office of Defense Mobilization immediately go in touch with the Director of the Office of Oil and Gas in the Department of the Interior to formulate plans to comply with this memorandum. On October 15, 1956, the Secretary of the Interior asked th chairman of the National Petroleum Council to arrange for the grou to meet in Washington.

The chairman of the National Petroleum Council and 15 member of the Council met with Government officials on October 19, 1956 The group discussed the tanker capability of the Free World's shipyards, particularly for large tankers—60,000 tons and over, and pertinent matters related thereto. Inasmuch as the Government was interested in getting industry's views as to the size of the tankers that the industry was planning in its construction schedules and whethe private industry would buy tankers of an agreed-upon size for a period of 24 months if such a program were set up, the Director of Defense Mobilization, who presided as chairman of the meeting, called another meeting for October 25, 1956. This was done to afford the industrialists an opportunity to further study the matter and to enable them to give estimates as to what their companies might do.

On October 25, 1956, the second meeting was held. It was suggested that the National Petroleum Council make a tanker study and supply whatever factual information was needed by Government. This suggestion was offered in view of the fact that apparently a large number of tankers were planned for construction by industry and it did not appear that the individuals from industry present at these meetings were in a position to state future company plans on tanker construction. With that decision made, the Director of Defense Mobilization referred the matter to the Department of the Interior for further action.

Then, on October 29, 1956, the Assistant Secretary of the Interior in charge of mineral resources made a request upon the National Petroleum Council. The request called for a study of petroleum tanker ransportation that includes the United States and worldwide con- truction schedules, by number and size, between now and 1965, with- ut regard to registry.

The National Petroleum Council undertook the study at once, naking an interim report on December 14, 1956. This interim report ontains data such as a statement showing the number and tonnage f tankers reported under construction or on order as of November , 1956, information on the salient characteristics of typical tankers f various sizes, and data on drydocks capable of taking ships of 02′ beam.

A final report, World Petroleum Tanker Construction, was sub- itted to the Secretary of the Interior on March 7, 1957. That tanker eport of detailed information on the worldwide tanker construction rograms includes data on tankers under construction, on order, or efinitely planned.

The World Petroleum Tanker Construction Report indicates that he worldwide tanker fleet will be greatly expanded in the next 10 ears, with a significant increase in the number of large tankers. reviously, Government had no accurate long-range information of is nature.

This report is being used in Government in further studies of world- ide petroleum transportation problems, particularly as related to ovements from the Middle East.

WARTIME PLANNING AND THE MILITARY PETROLEUM ADVISORY BOARD

Most of the defense planning with respect to oil and gas within the ast 3 years has been based on a wartime petroleum and gas supply- emand study which was started in September 1954 and completed e following March.

This was the first such study which included damage factors of emy attack with thermonuclear weapons within the continental nited States. This study was carried on by the Office of Oil and as in cooperation with the oil and gas industries, through the Mili- ry Petroleum Advisory Board, a group of foremost technical experts the oil and gas industries. Strategic assumptions and guidance ere provided by the Department of Defense. The report on this udy has been of great value to the Department of Defense, the epartment of the Interior, and to the Office of Defense Mobilization, t it is now out of date.

Last spring the Department of Defense notified the Office of Oil d Gas that it was preparing the strategic assumptions and guidance for a new war study for which a new worldwide petroleum and gas supply-demand study would be required. As a result, by joint request of representatives of the Departments of Interior and Defense, the Military Petroleum Advisory Board has under way the new study which will provide the up-to-date petroleum and gas information and interpretation as necessary, to the Departments of Interior, Defense, and the Office of Defense Mobilization in their national security and defense planning.

PEACETIME STUDIES AND THE NATIONAL PETROLEUM COUNCIL

Government continued to rely on the National Petroleum Council for help and cooperation in providing basic petroleum information and advice on requests made upon it.

At the request of the Office of Oil and Gas, the Council completed several important studies, in addition to the one already mentioned, covering the underground petroluem storage situation in this country, and manpower in the oil and gas industries, and made reports thereon for use of Government.

The Council is now engaged in studies to furnish data and reports covering domestic petroleum transportation, refinery capacity, availability of liquefied petroleum gas, petroleum storage capacity, and petroleum productive capacity. Information on these will be valuable to Government in its consideration of the short-term and long-range petroleum situation, and are basic to a re-evaluation of our oil and gas capabilities in event of war.

STAFF ADVICE AND ASSISTANCE

The small staff of executive and technical experts gave advice and assistance to the Secretary of the Interior and to the personnel of other Government agencies on a wide range of petroleum and gas matters affecting the utilization of the petroleum and gas resources in the Nation's expanding economy. Over 40 Government agencies have an interest in petroleum and gas matters.

RELATIONSHIP WITH CONGRESS

The Office of Oil and Gas rendered service to Congres in supplying information on every query brought to its attention by Members of Congress and their professional and secretarial assistants. Officials of the Office also presented information and were witnesses at congressional committees in the conduct of petroleum and gas investigations.

SERVICE TO THE PUBLIC

In its daily operations, citizens from all walks of life have called upon the Office of Oil and Gas for information or guidance on indi-idual problems. Public understanding of Federal oil and gas administration and activities has been furthered in addresses and statements issued from time to time by the Secretary of the Interior, the Assistant Secretary-Mineral Resources, and the Office of Oil and Gas officials.

FOREIGN RELATIONS OF OFFICE OF OIL AND GAS

The Office of Oil and Gas was active in North Atlantic Treaty Organization activities. It is essential that the NATO planning be ealistic and sound as well as coordinated properly with the wartime lanning of this country and, for that reason, the Office sent a petro-eum adviser to meetings of the NATO Petroleum Planning Committee and provides the chairman for its Working Group.

Several meetings were held in Paris, France. Either the Director r the Assistant Director in charge of programing of the Office of Oil and Gas, or both, participated in these sessions.

At the request of the Department of State, an Office of Oil and Gas pecialist on gas was the United States delegate to the Nato Public Utilities Working Party when it met, in September 1956, in Paris, rance, to review the civilian defense aspects of gas supply, which s principally manufactured gas, for European cities.

Also, in the foreign field, the Office of Oil and Gas worked closely with the Organization for European Economic Cooperation. Its Petroleum Committee concentrates on the contribution petroleum can ake in the development of Europe's economy. While the United tates is not a member of this organization, Government officials ork closely with it in supplying technical advice.

FEDERAL CIVIL DEFENSE ACTIVITIES

Federal Civil Defense Administration Delegation No. 3, dated ugust 13, 1955, delegated authority to the Secretary of the Interior o plan and direct Federal activities designed to procure, store, trans-ort, and distribute adequate fuel supplies in a civil defense emergency. Responsibilities for taking action to organize and plan for olution of petroleum and gas supply problems under emergency con-itions was assigned to the Office of Oil and Gas.

General principles for handling of petroleum and gas during an mergency were formulated by the Office of Oil and Gas after it had made a preliminary survey as to what plans FCDA and the States ere making to cope with petroleum and gas supply problems. For the first time, guidelines, including organizational and operational charts, have been made available and distributed for use by civil defense officials in local, State, and regional organizations and to Federal agencies whose planning would be affected by the Federal Government's petroleum and gas plans.

The main principle to be followed is that the Federal Government will exercise overall control of primary petroleum supply in periods of extreme emergency. Secondary oil supply will be controlled at the local level by civil defense or rationing authorities.

Operation Alert 1956 was held during July, and the staff of the Office of Oil and Gas participated in this exercise.

INDUSTRIAL EXPANSION GOALS AND ACCELERATED TAX AMORTIZATION

The Office of Oil and Gas was responsible for departmental activities regarding the industrial expansion of the oil and gas industries needed to build up the mobilization base. Accelerated tax amortization was available for facilities qualifying under established criteria. Policy guidance for the program was given by the Office of Defense Mobilization.

The Office of Oil and Gas continued its function of analyzing the applications for rapid tax amortization and submitting reports to the Office of Defense Mobilization.

ODM closed certain goals following studies which indicated that sufficient capacity is planned or exists to meet known mobilization requirements. The goal covering construction of alkylation facilities was closed on December 28, 1956, one for oil and gas pipelines for specific defense programs was closed on April 25, 1957.

Following the closing of those goals, only two expansion goals established by ODM which might be applicable to certain types of petroleum and gas facilities, as well as those of other industries, remained open. These were Goal No. 224 (Production Facilities for Military and Atomic Energy Procurement) and Goal No. 206 (Laboratories, Research and Development). Under Goal No. 224, oil and gas pipelines used solely to supply military installations or Atomic Energy Commission projects and petroleum storage facilities erected solely for military use could be considered for accelerated tax amortization.

Reports and recommendations were made to ODM covering 245 applications for accelerated tax amortization and post certification actions during this fiscal year. The Office of Oil and Gas submitted 43 recommendations for approval of certificates of necessity for accelerated tax amortization, and 59 for denial of certificates; 96 scope amendment requests were recommended for approval, and 6 for denial; 39 recommendations for approval of time extensions, and 2 for denial.

COOPERATION FROM STATES

The Director of the Office of Oil and Gas represented the Department of the Interior at the Interstate Oil Compact Commission meetings. Cooperation from the State oil and gas regulatory agencies was received in daily contacts of the Federal Petroleum Board in administering the Connally Act.

CONNALLY ACT ADMINISTRATION

Mandatory authority of the Office of Oil and Gas was limited to administration of the Connally Act which supports the conservation activities of the oil producing States. The act, which became effective February 22, 1935, prohibits interstate shipment of oil produced in violation of certain State oil and gas conservation laws and orders issued thereunder.

Administration of the Connally Act is carried on by the Federal Petroleum Board under direction of the Secretary of the Interior and supervision of the Office of Oil and Gas. The Federal Petroleum Board consisted of a chairman and a member during the fiscal year, as the alternate member post was vacant. The Board was headquartered in Kilgore, Tex., and maintained field offices at Midland and Victoria, Tex., and Lafayette, La.

While the Connally Act is applicable wherever State laws limit the rate of production and prescribe conditions for producing and handling of oil, its chief application is in the States of Texas, Louisiana, and New Mexico, whose regulations prescribed under the act are enforced by the Board. So far as possible with the limited resources at its command, the Board also enforces the provisions of the act in other oil-producing States, particularly in Mississippi, Oklahoma, Arkansas, and Kansas.

Unless special exemptions are made by the Board in writing and by notice, all operators producing oil within the designated area are required to maintain daily production records and file monthly production reports of operations on each lease in the oilfield as prescribed n the form applicable to the producer; also transporters and refiners are required to file monthly reports on prescribed forms with the Board at Kilgore, Tex. The designated area consists of 106 counies in the State of Texas, the counties of Lea and Eddy in the State f New Mexico, and the entire State of Louisiana.

From the designated areas the Board regularly received and proessed each month approximately 9,007 monthly producer's reports, about 501 monthly pipeline reports, and 71 reports from processors and refiners. These reports covered operations in 3,422 separate oil fields and accounted for approximately 63.01 percent of the entire production in the States of Texas, Louisiana, and New Mexico, which was approximately 4,237,281 barrels daily.

During this fiscal year reports covering oilfield operations increased from 2,998 to 3,422 oilfields, an increase of 424 fields. The reports on producing wells increased from 81,878 to 88,371, an increase of 6,493 wells added to the inspection area in one year.

In this fiscal year, 2,199 leases were inspected, 2,698 leases were visited, and 15 pipelines were checked. To accomplish this, 425 oilfields were visited, and 957 investigations were conducted.

There were 9 cases of alleged violation of the Connally Act on the docket of the Federal Petroleum Board when the fiscal year began. Twelve new investigations were started during the fiscal year.

Six cases were closed by court action during the fiscal year, and fines paid amounted to $52,100.

On June 30, 1957, of the 15 cases on the docket, 7 cases were pending disposition by the United States attorneys, 3 were under review by the Solicitor's office, and 5 were under investigation by the Board.

DEFENSE MINERALS EXPLORATION
DMINISTRATION

C. O. Mittendorf, *Administrator*

HE PROGRAM to encourage exploration for deposits of strategic
nd critical minerals in the United States, its territories and posses-
ions conducted by the Defense Minerals Exploration Administration
ursuant to a delegation of authority from the Office of Defense
obilization to the Secretary of the Interior was continued during the
scal year 1957.

Under this program assistance to private industry is provided by
e Government through the DMEA participating in the costs of
xploring for critical and strategic minerals to the extent of 50 or
5 percent, depending upon the mineral or minerals sought. Funds
or the Government's share of the exploration costs are allocated from
e borrowing authority under the Defense Production Act of 1950,
s amended. Based upon sound engineering and geological principles,
xploration projects are established by contracts between the Gov-
nment and mine operators. These contracts call for specific work
be performed within specified costs on definite areas or parcels of
nd and to be completed during a fixed period of time. If, in the
inion of the Government, the exploration work has been successful
finding ore, a Certification of Discovery or Development is issued,
d the contribution to the cost of the work by the Government is
payable on a royalty percentage basis of 1½ to not more than 5 per-
nt of the sales receipts for any ore produced from the date of the
ntract until a specified time, usually 10 years, has elapsed from that
te, or the amount of the Government's contribution has been repaid
full, whichever occurs first.

The DMEA administers the program with a small Washington
aff, five field auditors, and the cooperation of the Federal Bureau of
ines and the Geological Survey in providing technical field services.
rivate industry participation in the program, represented by indi-

viduals, partnerships, and corporate enterprises, is widespread. The program is especially appealing to small business as evidenced by the large number participating.

During the fiscal year 1957, 406 applications for Government aid were received, bringing the total number of applications received since the beginning of the program in mid-1951 to 3,585. This total includes requests for aid on projects located in 43 States and Alaska. The DMEA has executed 127 contracts in the 12-month period ending June 30, 1957. The total number of contracts executed since the inception of the program is now 1,038. These contracts represent exploration projects in 34 States and Alaska, and as a group, include 28 different metals and minerals. At the beginning of the fiscal year 1957, there were 198 contracts in force, but this figure dropped to 194 at the end of the fiscal year. From the start of the program to date, 66 contracts have been canceled without any work having been performed on them. Only 4 of these 66 contracts were canceled in the past fiscal year. Government commitments made under contracts during the past 12 months amounted to $4,752,433, and now total $30,931,435. The total estimated cost of the 127 contracts and amendments executed during fiscal year 1957, including industry participation, amounts to $7,692,916, and for the 1,038 contracts executed and amendments since the beginning of the program is $50,290,152.

In the past 12 months, 76 contracts under which actual work was performed were terminated without certification of discovery or development. The cost of these 76 projects was originally estimated at $2,547,242, with Government participation set at $1,484,667, but the actual cost to the Government was only $873,236. At the end of the fiscal year, 503 contracts having a total project cost of $13,576,697 had been terminated without certification. The Government's share in the cost of these contracts was estimated at $8,504,995, of which only $5,046,791 was expended. Although a few of these terminated projects have found small quantities of ore, the amounts were not sufficient to warrant their being certified. However, valuable geological information was obtained from all of these terminated projects.

Certifications of discovery or development issued by the DMEA in the past 12 months totaled 53. These certified projects had an aggregate cost of $4,951,380. Although the Government was committed to participate to the extent of $3,259,483 on these 53 projects, only $2,905,819 of Government funds were actually expended. As of June 30, 1957, 299 projects having a total cost of $18,082,842, have been certified by the DMEA. Participation by the Government in these 299 projects was set at $11,394,778, but only $9,113,481 has been ontributed by the Government to date, since work on some of the rminated projects was completed at less cost than anticipated and e work on others is still in progress. Repayments to the Govern- ent in the form of royalties at the end of the fiscal year 1957 totaled 1,886,387 from 325 operators. One hundred and eighty-seven of ese 325 operators paid $538,684 during the past 12 months. Some 7 operators have paid in full the amount of the Government's par- cipation in their projects totaling $447,212.

The 299 certifications were on projects carrying out exploration for ntimony, asbestos, beryl, chromium, cobalt, columbium, copper, co- undum, fluorspar, iron, lead, manganese, mercury, mica, monazite, ickel, rare-earths, rutile, sulphur, talc, tantalum, thorium, tin, ungsten, uranium, and zinc. Fifty-four of the certified projects ere in North Carolina, 42 in Colorado, 37 in Utah, 26 in Idaho, 18 in alifornia, 17 in Nevada, 15 each in Arizona and Montana, 12 in ashington, 10 in Wisconsin, 8 in South Dakota, 7 in New Mexico, in Alaska, 5 in Georgia, 3 each in Alabama, Illinois, Missouri, and yoming; 2 each in Arkansas, Virginia, and Vermont; and 1 each Florida, Iowa, Maine, New Hampshire, New Jersey, Oregon, South arolina, Tennessee, and Texas. Twenty-two of the 299 certified proj- ts had not been completed as of June 30, 1957. At prices in effect the end of the fiscal year a conservative estimate of the recoverable lue of the ores and minerals found on the 299 certified projects is proximately $444 million. Substantial ore-showings disclosed on other projects may eventually lead to their certification.

Each application for an exploration project requires a study by chnical experts. In most cases an on-site examination is made of e proposed project by personnel of the Geological Survey and the ureau of Mines. Based upon a study of all available information, cluding the results of the field examination, the proposal is either nied or a project is approved and a contract executed. A total 1,755 applications have been denied as of June 30, 1957, 282 of em in the past fiscal year. A total of 637 applications have been ithdrawn, but only 74 in the past 12 months.

Applications were received during the past fiscal year at about the me rate as in the previous year but with some slackening off in the st few months. Uranium applications continue to be received in e largest number. The fewer applications for tungsten received in e last half of the year than in the first half evidently reflected the ding of the Government buying program for this material.

The Contract Administration and Audit Division of DMEA con- nued its auditing program at a steady rate. This Division had mpleted a total of 983 audits certifying Government disbursements of $15,033,464 on 832 projects, as of June 30, 1957. Of these 98 audits, 155 were made in this fiscal year and certified Governmen disbursements of $2,657,888. Of the 155 audits made, 126 covere projects not previously audited. To date approximately 80 percen of the exploration program disbursements have been audited. In addition, 48 audits have been made for production purposes in the las 12 months. Of these 48 audits 29 covered projects not previousl audited for royalty payments. The 48 audits covered sales of production totaling $5,281,880, on which royalties payable to the Government amounted to $262,378. As of June 30, 1957, 226 productio audits on 175 projects have been made involving ore shipments o $20,761,234, and royalties payable to the Government totalin $1,001,771.

In January 1957, the DMEA instituted new filing procedures whic reduced the volume of space by consolidating files and eliminatin some material no longer needed. The pamphlet titled "The Defens Minerals Exploration Program," explaining the program in questio and answer form, was revised so as to clarify certain questions and t bring it up to date with current procedures, and was made availabl in March 1957. In order to help the applicant in supplying information needed to process his application, the DMEA Form MF-103 "Application for Aid in an Exploration Project" was also revised in February 1957, and made available in April.

The fine cooperation of other Government agencies and extensiv participation of mine operators have aided materially in making the program a success. Particularly significant is the large number of small operators participating in the program. Approximately 60 percent of all contracts call for expenditures of less than $25,000, and 43 percent of all contracts provide for total expenditures of less than $3,000 of the operator's own funds. Individuals and partnerships comprise about two-thirds of the operators. Substantial quantities of strategic and critical minerals have been found. Although current production is small, the ultimate production from successful projects will be important to the Nation's economy and defense. On some projects deposits have been found that are uneconomic to mine under current conditions and market prices, but which will be available if needed in times of emergency. The deposits found under the DMEA program constitute an important element of the Nation's mobilization base.

OFFICE OF MINERALS MOBILIZATION

Spencer S. Shannon, *Director*

HE OFFICE of Minerals Mobilization was established in January 955 to carry out the Secretary's responsibilities for national defense reparedness in minerals, metals and solid fuels, under delegations rom the Office of Defense Mobilization.

During the past year, the Office has carried forward a program esigned (*a*) to assure an adequate supply of the 85 minerals, metals nd solid fuels under its jurisdiction to meet essential civilian and military requirements in the event of national emergency; (*b*) to rovide continuity of government under defense emergency and attack conditions; and (*c*) to provide continuity of industrial production f metals, minerals and solid fuels under defense emergency and tack conditions.

Working in close collaboration with the Bureau of Mines and Geological Survey, the Office completed during the year 20 compreensive mobilization base evaluations, 3 expansion goal studies and other special studies, and forwarded to ODM recommendations, ased on these reports, for action deemed necessary to achieve and to aintain an adequate national defense supply position. As of June , 1957, 16 comprehensive evaluations and reviews were in progress. In preparation were summaries designed to maintain current inormation on the mobilization status of all assigned strategic metals nd minerals for internal operational and policy reference.

In the case of solid fuels, the Office continued to carry out its responsibility for evaluating and recommending on applications by ndustry for certificates of necessity for accelerated tax amortization nder the Internal Revenue Code and for loans under the Defense roduction Act. Through June 1957 a total of 176 necessity certificates had been certified and 28 canceled with 148 still outstanding at a total value of $703,554,000. Of these 84 were for coke, 59 for metallurgical coal, 2 for coal in Alaska and 3 miscellaneous.

The Office continued working closely with other Government agencies having responsibilities for mobilization planning. Special attention was given to advising and assisting in connection with the Department of Agriculture's program on barter of agricultural surplus commodities for strategic metals and minerals.

In carrying out its responsibilities for assuring continuity of government in the event of a national emergency, the Office made progress in establishing operational facilities at the Relocation Center. Essential documents and files were assembled at the Center and procedures were established for maintaining them on a current basis.

Activities with respect to plans and readiness were continued toward the objective of preparedness for emergency operations of the minerals and solid fuels industry. To this end recruiting of executive reservists continued. During the year this Office appointed the first 15 of possibly 118 executive reservists who will serve in the minerals and solid fuels areas. Eleven others have expressed a willingness to serve in the event of an emergency.

Work was continued in developing standby control orders covering allocation of metals and minerals to be put into effect in the event of emergency, and in providing for adequate supplies of controlled materials to the producers of metals, minerals and solid fuels.

During the year data were collected on domestic production facilities for inclusion in the Office of Defense Mobilization's damage assessment program. An initial compilation was completed for 40 metal and mineral commodities which represent most of the facilities under the jurisdiction of the Office.

The Office continued to prepare data for and cooperate with the Industry Evaluation Board in the evaluation of industrial plants that fall within the purview of the Office.

OFFICE OF GEOGRAPHY

Meredith F. Burrill, *Director*

THE OFFICE OF GEOGRAPHY was established to carry out the responsibilities of the Secretary of the Interior under the act of July 25, 1947, conjointly with the Board of Geographic Names. The Office performs the research and other staff functions relating to the standardization of geographic names for use by the Federal Government.

The work of the Office in 1957 was chiefly concerned with names in areas outside the continental United States. Substantial files of standardized names were compiled for more than 20 foreign areas, increasing the size of such files to nearly 2 million names, including variant spellings, and extending their coverage to all areas of the world outside the continental United States. More than 450,000 names were edited on maps and in textual materials for correctness of spelling and accuracy of application, and nearly 10,000 mail and telephone inquiries were answered. Over 200,000 names were prepared for publication in eighteen gazetteers for public sale.

Nomenclature policies were reviewed and modified or augmented for several countries, and new source materials were brought into use for many areas.

BOARD ON GEOGRAPHIC NAMES

The Board on Geographic Names is an interdepartmental organization established by the act of July 25, 1947, for the purpose of standardizing geographic nomenclature for use by the Federal Government. Its members represent the Departments of State, Army, Navy, Post Office, Interior, Agriculture, Commerce, and Air Force, and the Government Printing Office, the Library of Congress, and the Central

Intelligence Agency. Dr. H. Thompson Straw, Department of th Air Force, was chairman during the fiscal year 1957.

The Board and its committees met frequently to act on nomenclatu policies, to approve names and to perform related functions. Ne policies were formulated and previous ones revised and extended.

In April 1957, Mr. P. J. M. Geelan, Secretary of the Permane Committee on Geographical Names for British Official Use, and M G. M. Munroe, Secretary of the Canadian Board on Geographica Names, visited the Board for conferences on policies to be used jointl in the standardization of foreign geographic names. Also the Boar was asked by the United Nations Economic and Social Council t draft a statement of principles to be used in the internationa standardization of geographic names.

A new Hawaiian Names Advisory Committee was appointed, an the Advisory Committe on Antarctic Names, the Alaskan Names Advisory Committee, and the Advisory Committee on Arabic and Persian continued active.

The Board's series of gazetteers of foreign areas was increased t 40 by the addition of coverage of numerous oceanic island areas an several countries including Australia, Iraq, Italy, and eight Lati American countries. The entire series now available for public sal contains over 690,000 entries. A revised statement of the Board' Transliteration System for Arabic Geographic Names (the BGN PCGN System) was also published.

Office of the Assistant Secretary
Public Land Management

Roger Ernst, *Assistant Secretary*

HE ASSISTANT SECRETARY for Public Land Management is
esponsible for directing and supervising the Bureau of Land Man-
gement, the Bureau of Indian Affairs, the National Park Service,
nd the Office of Territories. The Fish and Wildlife Service, formerly
nder his direction, received separate status in fiscal 1957 and now
perates under its own Assistant Secretary for Fish and Wildlife.

During the past year each of the four bureaus scored impressive
dvances in the continuing drive to serve the public.

As economies expand in the public land States, new patterns of
rowth are shaped and the pattern of land usage changes. The Bu-
eau of Land Management activities are influenced by growing de-
ands on the lands and their resources. To meet those demands, the
ureau is using all available means to improve its operations.

Final regulations under the Multiple Use Act were issued last year.
he law empowers the Government to manage surface resources on
npatented mining claims subject to the act. It also removed certain
inerals from the mining laws and placed them under the Materials
ct. Indications are that industry and the Nation as a whole will be
enefited by opening vast timber resources.

Centralized, unified control of appeals actions has substantially
educed the backlog of lands and mineral cases on appeal to the Di-
ector. The Appeals Office's prompt and efficient dealing with cases
as improved services to the public and smoothed the Bureau's opera-
ons. Appeals work has been separated from staff operations. Estab-
shed in April 1955, the Office last fiscal year won a unit citation for
eritorious service for its first 2 years of operations. The citation
knowledged the Appeals Office's enviable record and superior ac-

complishments in volume of cases processed and for the quality o its decisions.

The task of improving the public land records continued last year Three major projects included reconstruction of the Utah and New Mexico land records and purchase of auxiliary equipment for the new records system.

During fiscal year 1957 the Bureau of Indian Affairs continued to stress educational and economical programs. Emphasis was maintained on the educational needs of Indian children, and enrollment of the youngsters hit a record total. Meanwhile, new efforts were made in the field of adult education. The special literacy training program for adults, begun in fiscal 1956, was expanded last year. Plans were completed for starting an adult vocational training program this year

One of the more important economical developments of the year was the establishment of eight new industrial plants in the vicinity of Indian reservations.

Income from mineral leasing rose to new highs in the past year. Oil leases provided the greatest sums. But timber sales also soared to a record.

Two tribal groups reached the point last year where they were able to move out from under Federal trusteeship. Another group had left Federal trusteeship a year earlier. Three more groups are working toward terminal dates already set up, and three additional tribes are covered by readjustment laws enacted during the year with the tribes' concurrence.

The Mission 66 program of the National Park Service and the National Park System completed its first year in fiscal 1957. Mission 66 is a 10-year program of conservation, development, and improvement aimed at providing facilities for 80 million visitors by 1966, when the Service will celebrate its golden anniversary.

The Virgin Islands National Park was added to the System last year. Congress authorized the establishment of Horseshoe Bend and Pea Ridge National Military Parks. Officially established in the first year of Mission 66 were the Cape Hatteras National Seashore Recreation Area, Independence National Historical Park, Edison Laboratory National Monument, Fort Union National Monument, Booker T. Washington National Monument, Harpers Ferry National Monument, Chimney Rock National Historic Site and Golden Spike National Historic Site.

The Colonial Parkway and new visitor centers at Jamestown and Yorktown were completed in time to be used by the thousands of persons who visited the Jamestown-Williamsburg-Yorktown celebration.

The year also saw publication of the popular version of the official report on "Our Vanishing Shoreline." It made many readers aware of the loss which threatens unless quick action is taken to preserve some of the shoreline which has so far remained unspoiled.

Additional concession facilities were provided in a number of areas. Prominent among them are the new Canyon Village in Yellowstone National Park and the Colter Bay development in Grand Teton National Park.

One of the most cheerful aspects of the year for the Office of Territories was the substantial progress which Alaska made toward achieving statehood. There is a possibility that in fiscal 1958 Alaska may become a State. Hawaii also showed progress in its campaign for statehood. The Administration is firmly determined that both shall be admitted to the Union as full partners instead of Territories.

In Alaska, for the first time, an Alaska-born citizen was named Governor. A similar first was scored in American Samoa when a native-born Samoan was named Governor.

Self-government in Alaska and Hawaii has advanced to the point where the Department need provide few political services.

The Office of Territories discontinued two of its functions in Alaska in fiscal 1957. The Department of Commerce took over the road-building and maintenance functions of the Alaska Road Commission, and Alaska's mental health program was transferred to the Territorial Government. The Alaska Railroad operated without congressional appropriations and increased its commercial services.

The Virgin Islands Corporation had one of its most successful years. It was unnecessary, for the first time in years in the Islands, to borrow money to finance current operations. American Samoa's fiscal affairs also are in good order. Guam's economy continues favorable. In the Trust Territory, a stabilization fund has assured Micronesians a steady income from copra despite declining prices.

BUREAU OF INDIAN AFFAIRS

Glenn L. Emmons, *Commissioner*

IN THE BUREAU of Indian Affairs continued progress was made in 1957 toward the ultimate goal of full educational and economic opportunities for Indian people.

Enrollment of Indian children in schools of all types reached a record total of about 132,000. On the Navajo Reservation, where lack of facilities was a problem of major proportions just a few years ago, the enrollment was stepped up by nearly 7 percent over the preceding year and passed the 27,000 mark. Active steps were also taken in 1957 to enlarge schooling opportunities in two other areas where lack of facilities has been a problem—the Choctaw jurisdiction of Mississippi and the Territory of Alaska.

In addition, greater attention than ever before was given to the educational needs of Indian adults. The special literacy training program, which the Bureau launched on five reservations in 1956, was continued in 1957 and expanded to include additional tribal groups in Arizona, New Mexico, and Alaska. Plans were also shaped up for initiating in the 1958 fiscal year an adult vocational training program as authorized by Public Law 959, approved August 3, 1956. Although the law authorizes annual appropriations of $3,500,000, an appropriation of $1,500,000 was requested for the first year of operations.

On the economic side one of the most important developments of the year was the establishment of eight industrial plants in the vicinity of Indian reservations in addition to the furniture factory at Gallup, N. Mex., and the leather goods plant at Cherokee, N. C., which were set up in 1956. Two of the new plants are in Arizona, providing employment for Navajo, Pima, and Papago Indians; three in South Dakota (including the reopened Flandreau garment factory) near the Sioux reservations; and one each in Montana, North Carolina, and Washington. Altogether they are expected to train and employ perhaps as many as 700 Indian workers in 1958.

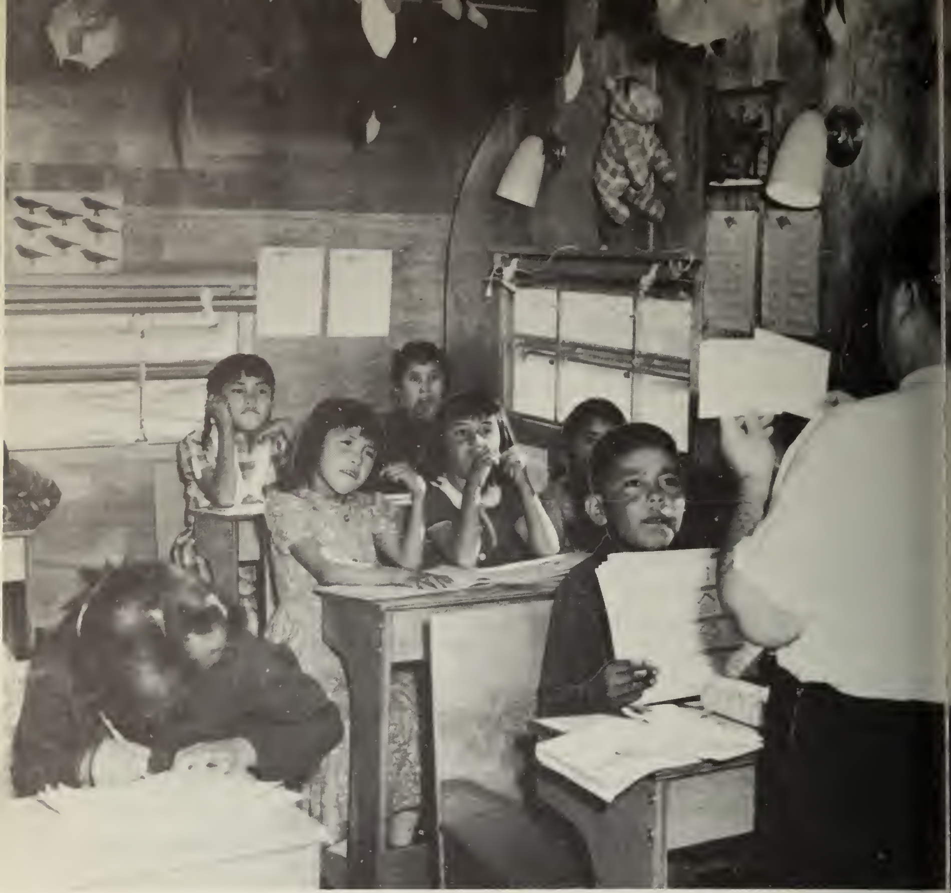


FIGURE 21.—Through the use of trailer schools education was brought for the first time to some of the remoter parts of the huge Navajo Reservation in Arizona and New Mexico.

Meanwhile an increasing number of people on the reservations evidenced an interest in the broader economic and social opportunities available in metropolitan areas and requested Bureau assistance in relocating, either singly or in family groups, to cities such as Los Angeles, Denver, Chicago, and St. Louis. Nearly 7,000 persons (including 1,302 family units and 1,580 unattached individuals) received assistance under the relocation services program as compared with slightly over 5,000 in 1956. At the close of the period plans were being made to open new field offices in suburban communities such as Joliet and Waukegan, Ill., and to expand relocation service operations into States such as Ohio and possibly Texas.

Income to the Indian people from the direct use or leasing of their lands and other resources on the reservations mounted to impressive totals. As usual, however, some groups and individuals benefitted far more heavily than others. With the Navajo Tribe receiving nearly $35 million from bonuses on oil leases, chiefly in the "four corners" area of the reservation, the total income to all tribal groups and individuals from mineral leasing soared to an all-time high of over $75 million. This compares with about $43 million in 1956. Income from timber sales also reached a new high of more than $14 million which was 23 percent greater than the record total of the preceding year. Agricultural and grazing income showed no substantial change.

Under the heading of "readjustment legislation" (i. e., legislation providing for the gradual assumption of full autonomy by the affected tribal groups) there were several important developments. Of the six groups covered by readjustment laws passed in 1954, two more reached the stage of final severance from Federal trusteeship. These were the coastal Oregon tribes of the former Grand Ronde-Siletz jurisdiction and four small Paiute bands of Utah. The Alabama-Coushatta group of Texas had already moved out from under Federal trusteeship one year earlier. This left the Menominee of Wisconsin, the Klamath of Oregon and the "mixed blood" Utes of Utah still facing terminal dates in the comparatively near future. Three additional groups—the Wyandotte, Peoria and Ottawa Tribes of Oklahoma—are now covered by readjustment laws enacted during the year in response to their own requests.

NAVAJO-HOPI REHABILITATION

In its seventh year of operations, the 10-year special program authorized by the Navajo-Hopi Rehabilitation Act of 1950 was, to a large extent, merged into the broader pattern of Indian Bureau activities in the two tribal areas. While the funds for the 10-year program work were handled separately and were charged against the authorizations set up under various categorical headings in the 1950 law, the work itself represented only a part—and, in most spheres of action, a minor part—of the Bureau's total program for the benefit of the two tribal groups.

As indicated in last year's report, funds transferred to the Public Health Service by the Indian Bureau in 1956 for the construction of health facilities exhausted the $4,750,000 authorization for "hospital and health facilities" originally established in the Rehabilitation Act. In 1957 the available funds were used by the Health Service for the construction of health centers at five localities and the expansion and renovation of clinics at three others. In addition, funds were allocated for the construction of a 200-bed medical center at Gallup, N. Mex., and a new 75-bed hospital at Shiprock, N. Mex., near the northeast corner of the Navajo Reservation. None of these projects was completed during the year.

Under the heading of school construction, work moved forward on 13 projects authorized the preceding year which will eventually enlarge the capacity of reservation schools by 442 students. Four additional projects were authorized in 1957 bringing the total amount allocated up to $24,527,295 of the original $25 million authorization for school construction and similar work. The basic goal is to provide school accommodations near the home for all Navajo children through grade 6 and to arrange public schooling either on or off the reservation for those in the higher grades.

Most of the irrigation work accomplished during the year was on the Hogback project where $341,579 was used to repair the rock-filled diversion dam, increase the discharge capacity and construct a concrete sluiceway and control works. Meanwhile the Navajo Tribe initiated a training program in irrigation farming techniques on the Hogback project with a group of 16 trainees.

Roadbuilding funds appropriated under the 1950 authorization were used in 1957 chiefly for continuation of work on Route 3 which will eventually cross the Navajo Reservation from Window Rock on the east to Tuba City on the west for a distance of over 125 miles. The 1957 accomplishments included the grading, drainage and surfacing of 11.4 miles from Tuba City to Coal Mine Mesa, construction of a bridge across Ganado Wash, and widening of a bridge spanning Fish Wash. Work was also initiated on the construction of a bridge across Chinle Wash at a point 75 miles west of Shiprock, N. Mex. In addition, the road funds were used to build airstrips at three isolated school localities and to improve the existing strips at three others.

In the sphere of soil conservation and range improvement work, major emphasis was placed on eradication of juniper and sagebrush, development of water-spreading structures, and reseeding of the range. The $707,540 of program funds allocated for this work in 1957 was supplemented by $87,000 of tribal funds and by $200,000 from the Agricultural Conservation and Stabilization Service. Navajo land users themselves contributed labor and materials valued at over $1,100,000.

The industrial development phase of the rehabilitation program, which started out with major emphasis on the creation of small tribally operated enterprises on the reservation, has now been reoriented, with full tribal concurrence, into a program designed to induce established private industries to locate subsidiary plants in areas adjoining the reservation. The Tribal Council has pledged to collaborate with neighboring communities in providing necessary plant facilities, subsidizing employee training, and offering other attractions. In 1956 the tribe employed an industrial manager, set up an industrialization department in its tribal administration, and began collaborating with peripheral communities. In 1957 the tribe appropriated an additional $300,000 of its own funds for a continuation of this program.

Minor allocations of Rehabilitation Act funds were made in 1957 for other phases of the program such as voluntary resettlement of Navajo and Hopi families on the Colorado River irrigation project, surveys and studies, and off-reservations relocation.

PROGRAMMING FOR SOCIAL AND ECONOMIC PROGRESS

Efforts to encourage the Indian tribes to work out and adopt programs for their own social and economic betterment, initiated by the Commissioner's memorandum of April 12, 1956, were pushed forward throughout the year. The Commissioner personally spearheaded the movement by holding, between July and December, 1956, a series of consultative meetings throughout the West with elected officers of nearly all the major tribes.

Meanwhile, the work was also going forward at the "grassroots" or reservation level. Thousands of copies of the memorandum were distributed to the Indians. Hundreds of meetings were held during the year to many of which State and county officials were invited to join with the Indians in discussing their community problems and devising programs which would contribute to their solution. Emphasis was laid, in this initial phase, on the necessity of (*a*) organizing the tribes for programming, and (*b*) assembling basic data on present conditions and needs.

In sum, a new awareness was created among the Indians regarding opportunities for self-improvement and community development, which, in many cases, exist at their very doorstep. Some embraced hese opportunities eagerly; others held back. But a significant beginning was made.

Dalles Dam Settlement Fund

The Yakima Tribe of Washington, the Confederated Tribes of the Warm Springs Reservation and the Umatilla Tribes, both of Oregon, and the Nez Perce Tribe of Idaho were awarded a total of about $27 million for the loss of their treaty rights to fish at Celilo Falls on he Columbia River. Construction of the Dalles Dam by the Corps of Engineers, authorized by the River and Harbor Act of May 17, 950 (64 Stat. 163–179), flooded out the fishing grounds.

The Bureau regards the Dalles Dam settlement fund as a capital sset and not as regular income from which per capita payments may be made to meet current expenses. It has therefore advised the tribes o plan to use their shares of the fund in long-term constructive programs. Once approved categories of allowable expenditures have been agreed upon, modest per capitas are being approved for debt clearance and other immediate needs; then the balance is to be programmed on an individual or family basis for land acquisition, home improvements, business investments, trust funds for minors, education allowances, and other constructive uses. The Nez Perce and the Warm Springs Tribes have adopted programs along this line; the other two tribes are in the process of planning.

Fort Mojave Constitution

On November 14, 1955, a proposed constitution and by-laws for the Fort Mojave Tribe of the Fort Mojave Reservation of Arizona, Nevada, and California was submitted for consideration. This proposed document was returned to the tribes on August 13, 1956, by the Secretary to permit the tribe to hold an election for its ratification. The tribal constitution was adopted in an election held on March 16, 1957, by a vote of 121 for, and 13 against, and became effective on May 6, 1957.

LEGISLATIVE DEVELOPMENTS

Missouri River Basin

Among the significant legislative items of the year were bills to provide for the rehabilitation of all enrolled members of the Crow Creek and Lower Brule Sioux Tribes of South Dakota, portions of whose reservations have already been taken for the Fort Randall Reservoir on the Missouri River. These bills follow the lines of legislation already enacted to aid the Fort Berthold and Cheyenne River Tribes, many of whose members were necessarily displaced and much of whose land was acquired for reservoirs farther up the river.

A bill to provide for the acquisition of lands by the United States required for the reservoir created by the construction of Oahe Dam on the Missouri River and for rehabilitation of the tribal members of the Standing Rock Sioux Reservation in South Dakota and North Dakota was also introduced. The bill would authorize an appropriation for rehabilitation of all enrolled members of the tribe. The value of land and improvements and indirect damages would be determined by negotiation between representatives of the Corps of Engineers and the Tribal Council subject to approval by the Secretary of the Interior.

New Readjustment Legislation

At the request of the Indian groups affected, a bill (H. R. 6364) was introduced to distribute the assets of 31 of the 115 rancherias n California for the benefit of the individual Indians. It would nable the Indians on the rancherias named to work out, with the pproval of the Secretary, a plan for the distribution. No time imit is set. The Secretary would be authorized to make surveys, omplete roads and water systems, and help the rancheria residents o form a legal entity to accept title to the property. Distribution ould be accomplished either by transferring title for the lands to a egal entity representing the group, or by selling the lands and di-iding the proceeds among the members. When the distribution is ompleted, the Indians participating would no longer be entitled to ervices provided to Indians by the Bureau.

In August 1956, Congress enacted readjustment or termination aws for three small tribal groups in northeastern Oklahoma: (1) the Wyandotte Tribe (Public Law 887); (2) Peoria Tribe (Public Law 21); and (3) the Ottawa Tribe (Public Law 943). These tribes pproved and requested the terminal legislation prior to enactment. The proposed rolls for the Wyandotte and Peoria Tribes have been published in the Federal Register. The Ottawa's roll was awaiting pproval of the Secretary at the end of the fiscal year.

READJUSTMENT PROGRESS

Federal trusteeship of two Indian groups was ended during the ear. On August 18, 1956, the Secretary announced the removal of Federal supervision of the Western Oregon Indians in accordance with Public Law 588, 83d Congress, August 13, 1954 (68 Stat. 724). On March 1, 1957, he issued a similar proclamation regarding four Paiute bands of Utah in accordance with Public Law 762, 83d Congress, September 1, 1954 (68 Stat. 1099). These terminations in-olved a total of 2,332 Indians (2,100 in Oregon and 232 in Utah) nd a total of 46,003 acres of tribal land (3,164 in Oregon and 42,839 in Utah.)

Menominees of Wisconsin

Shortly after the beginning of fiscal year 1957, the President signed into law two acts amending the 1954 legislation (Public Law 399, 3d Cong.) to terminate the special Federal trusteeship over the property and affairs of the Menominee Tribe of Wisconsin. The act of July 14, 1956, authorized appropriation of Federal funds to reimburse the Menominees for costs incurred in the 1954–58 transitional period insofar as those tribal expenses are a direct result of planning or unrestricted status. The Department immediately requested the ppropriation of $500,000 to be made available for such reimbursement; and the Congress allowed an amount of up to $300,000 to be vailable until expended for assisting the tribe.

Also approved on July 14, 1956, was Public Law 718, 84th Congress, "Relating to the plan for control of the property of th Menominee Indian Tribe, and for other purposes." This amendmen requires the Menominee Tribe to submit to the Secretary its plan fo taking unrestricted custody of its property not later than Decembe 31, 1957, which is 1 year prior to the statutory limit for the endin of Federal trusteeship. The congressional action also stipulated tha the tribe's plan shall provide for the management of the Menomine forest on a sustained yield basis, and for the protection of the water soil, fish and wildlife. In addition, this law gives the Secretary o the Interior discretion to transfer federally owned property on th reservation to the tribe, or its members, or to a public or nonprofi body for Indian use, without regard to the other laws governing th disposal of Federal property.

Klamaths of Oregon

The Commissioner developed in 1957 trusteeship procedures fo carrying out the protective requirements of Public Law 587, of August 13, 1954 (68 Stat. 718). Trust banks will reduce fee expense for trusts and yet provide necessary and adequate protective measures. Appraisal of the Klamath tribal assets was completed and action i being taken to carry out the subsequent requirements of the act.

Recognizing the many problems on the Klamath Reservation in carrying out the provisions of Public Law 587, including the possible destruction of a great natural resource, the Department of the Interior, by Executive communication of January 7, 1957, submitted a proposal to modify and amend the act. This amendment would postpone the sale of tribal assets until the end of the 2d session of the 85th Congress. A number of technical changes are also involved.

Utes of the Uintah and Ouray Reservation

Public Law 671 of August 27, 1954 (68 Stat. 868), provided for (1) distribution of the assets of the Ute Tribe of the Unintah and Ouray Reservation in Utah between the mixed-blood and full-blood members, (2) termination of Federal supervision over property of the mixed-bloods, and (3) a development program for the full-bloods.

Agreement between the mixed-bloods and full-bloods was reached during the year on division of tribal funds, credit activities, tribal enterprises, buildings, equipment, supplies, and range areas. This left only the timber and agricultural lands still to be divided. A number of factors, such as the pending redesignation of the irrigation project, delayed completion of the division within the 1-year period. An extension of time has been granted the two groups, ermitting them to complete their division work by not later than ecember 4, 1957. The full-bloods have adopted a long-range pro- ram which emphasizes the development of family planning, re- urces, credit, health, and education. It was approved by the Bu- eau on December 14, 1956.

onfederated Tribes of the Colville Reservation, Washington

Public Law 772 of July 24, 1956 (70 Stat. 626) restored to the Con- ederated Tribes of the Colville Reservation, Washington, ownership f 818,000 acres of ceded lands which had not been disposed of. The ct also provides that the Business Council of the tribes, in line with s own resolution of April 8, 1955, shall submit within 5 years from he enactment date a plan for terminating Federal supervision. Dur- ng the past year the Bureau and tribal officers agreed on procedures or determining the status of mining claims within the reservation, nd plans for an overall survey of human and economic resources nd a study of property titles.

INDUSTRIAL DEVELOPMENT

In its second year of operation the Bureau's industrial develop- ent program registered considerable progress in encouraging the stablishment of small plants on or near reservations for the em- loyment of Indian workers. Contacts were made by the Commis- ioner's assistant and representatives with numerous industries from ew York to Los Angeles in the fields of electronics, textiles, metal abrication, woodworking, plastics, and many others.

Negotiations continued toward expansion of (1) the previously stablished Navajo Furniture Industries, Inc., in Gallup, N. Mex., hich employs Navajos to manufacture juvenile furniture, and (2) he plant set up by Saddlecraft, Inc., on the Cherokee Reservation hich employs Eastern Cherokees to manufacture moccasins and ther leather goods. Each of these plants expects to provide on-the- ob training for 100 Indians in fiscal 1958.

In addition, seven new plants were opened on the periphery of eservations and one factory formerly operated by the Bureau was eopened under private auspices.

Lear, Inc., of Santa Monica, Calif., established Lear-Navajo at lagstaff, Ariz., for the assembly of electronic components.

Parsons & Baker Co., of Phoenixville, Pa., established Casa Grande ills at Casa Grande, Ariz., which manufactures knitted garments. he company is presently steadily employing Pima and Papago In- ians and anticipates training 100 Indians in 1958.

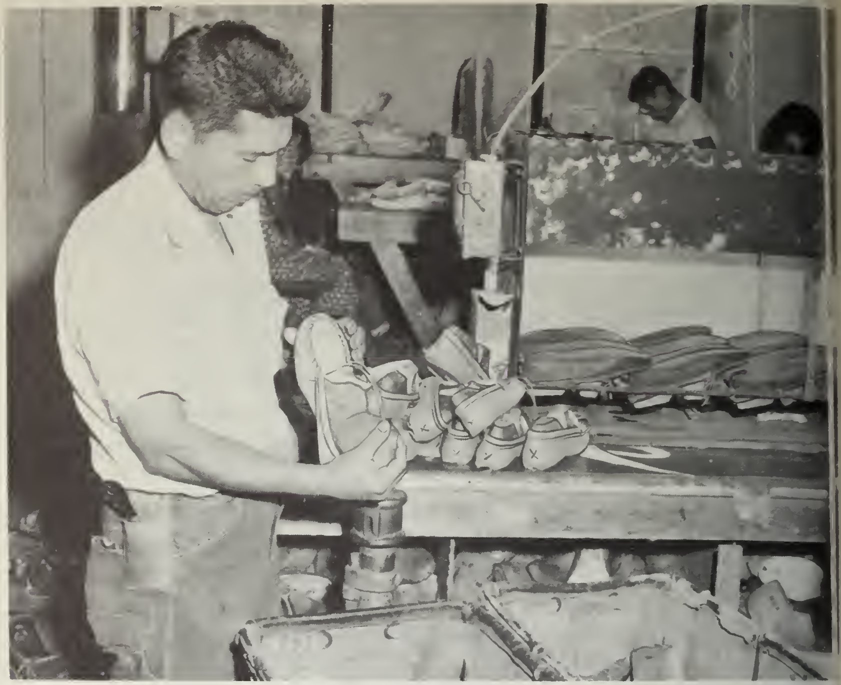


FIGURE 22.—The Indian Bureau's industrial development program brought ne job opportunities to reservation Indians in 1957. A factory making leath goods at Cherokee, N. C., was one of 10 such plants in operation.

The First Americans, Inc., was established at Lame Deer, Mont., t employ Northern Cheyenne Indians for the production of woodwor plastics, and electronics. This plant is steadily expanding and antic pates training 125 Indians during the year.

New Moon Homes, Inc., of Alma, Mich., established a plant i Rapid City, S. Dak., to manufacture house trailers. The compan anticipates training 100 Sioux Indians in 1958.

Tatanka, Inc., of McLaughlin, S. Dak., was established to manu facture toys and other woodwork. Steady employment is being give to Standing Rock Indians and future plans contemplate training 5 Indians.

Whitetree's Workshop on the Cherokee Reservation, N. C., is cur rently employing Eastern Cherokees in the manufacture of souveni items and will train 30 Indians during the year.

Bayly Manufacturing Co., Yakima, Wash., has expanded its gar ment-manufacturing operations and anticipates training 100 Yakim Indians.

The Flandreau Garment Factory at Flandreau, S. Dak., has been eopened and will employ approximately 25 Sioux Indians in the nanufacture of ladies apparel.

On-the-job training agreements were negotiated with the various ompanies participating in the industrial development program to e effective July 1, 1957, as authorized by Public Law 959, 84th Conress, approved August 3, 1956.

At the close of the period, additional negotiations were being acively carried forward by the Bureau with numerous industrial comanies, looking toward the establishment of plants near Indian popuation centers in Arizona, Minnesota, Montana, New Mexico, North Dakota, Oklahoma, South Dakota, and Wyoming.

EDUCATION

Approximately 124,000 Indian children of school age, 6 to 18 years, vere enrolled in public, Federal, mission, and other private schools n fiscal year 1957. About 60 percent attended public schools, 31 perent were in Federal schools, and 9 percent in mission and other priate schools. Public school enrollment increased by an estimated ,900 students in line with Bureau policy of transferring classes and chools from Federal to public school jurisdiction where feasible. In ddition, there were approximately 5,300 Indian children under 6 and ver 18 years of age enrolled in school, the majority in Federal schools.

Indian children are eligible to attend public schools on the same asis as other citizen children; however, tax-exempt, Indian-owned ınds and large numbers of Indian students within school districts ıay create financial burdens for which local funds are inadequate. In hese cases, the Bureau has authority under the Johnson-O'Malley ct (48 Stat. 596) to contract with States or local school districts and rovide financial aid. State and local contracts were negotiated durng the year in 19 States and the Territory of Alaska to assist finanially in the public school education of approximately 40,000 Indian udents.

New construction and expansion of present Federal school facilities s required to provide for the rapid increase in population, to absorb ie backlog of school-age children not enrolled in any school, and to elieve excessive overcrowding. Long-range projection of school uilding needs has been charted and will be adjusted annually as arranted.

The Bureau of Indian Affairs operated 79 boarding and 229 day chools in fiscal 1957. The day schools include 12 instructional aid chools in Alaska, and 1 hogan and 2 literacy units on the Navajo eservation. Classes were conducted for patients in 4 Indian hospitals operated by the Public Health Service, and dormitory accommodations were provided for 2,900 students attending public school i 16 locations.

Progress in the educational field on the Navajo Reservation wa slightly greater than that achieved in 1956, a record year. Enrollment increased by 6.83 percent as compared to an increase of 6.7 percent for the preceding year and reached an all-time record o 27,013 students. The approximately 7 percent annual increase i Navajo enrollment may be compared with an annual increase of abou 4 percent for the Nation as a whole. Enrollment includes students attending reservation day and boarding schools; mission and other private schools, public schools of the peripheral communities; and off reservation Federal boarding schools in Arizona, California, Kansas Nevada, New Mexico, Oklahoma, Oregon, and Utah.

Of the Navajo school-age children enrolled in the 1956–57 schoo year, 32.2 percent were in public schools, 61.4 percent in Federa schools, and 6.4 percent in mission and other private schools. Of th approximately 8,300 attending public schools, 1,460 lived in Federa dormitories in 6 towns bordering the reservation.

The number of school-age Navajos not enrolled in any school wa decreased by more than 1,700 in fiscal year 1957 to a record low figur of 3,098.

Improvement of Standards

In 1957 the Bureau emphasized better management of its schools through development of standards in construction, school operations and a supervisory evaluation guide.

On the construction side, standards were developed for space requirements for classrooms, dormitories, kitchens, dining rooms, bathrooms, and outdoor play areas. These standards will assure uniform planning of school facilities and will greatly reduce cost in terms o time and money spent in the preparation of preliminary drawings and estimates. A master list of essential major equipment and supplies for Indian schools, also compiled in 1957, will facilitate procurement of necessary items at reasonable cost and with minimum delay.

Over the past 4 years the Bureau has been developing criteria which may be used by each of its schools for evaluating their own operations. In 1957 the criteria were used in evaluating operations at four boarding schools and 14 day schools. Revision and refinement of the criteria were made following each use and the criteria have now reached the stage where they can be formalized and used throughout the Bureau in supervisory evaluation of school operations.

Adult Education

During the year the Bureau continued to operate and expand its pilot program in adult education which was started during the previous year in 5 tribal jurisdictions where the need was especially acute. These are the Seminole of Florida, the Papago of Arizona, the Turtle Mountain Chippewas of North Dakota, the Rosebud Sioux of South Dakota, and the Shoshone-Bannock at Fort Hall in Idaho. Additional projects were initiated during 1957 in the Navajo and Pueblo areas of Arizona and New Mexico, at the Tacoma Sanitorium in the State of Washington, and among the native Alaskan groups.

The adult education program is operated for the purpose of reaching he large group of adult Indians who are disadvantaged by lack of chooling and who need and desire help in adjusting to modern life; n the development of social, economic, and civic understanding; and n the improvement of language and numerical skills. The instrucional content of the program is broad in scope and limited in content only by what adult Indians want to learn and the teaching staff is ualified to teach. In most cases it would encompass much more than mere instructions in speaking, reading, and writing the English anguage. It aims at serving educationally the everyday needs of dult Indians.

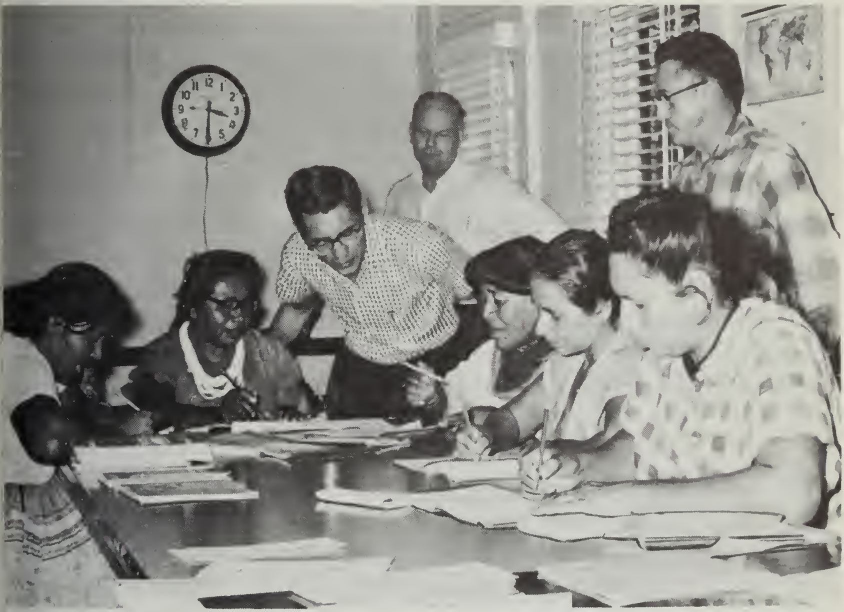


FIGURE 23.—Adult Indians who missed the opportunities of education in childood get their chance today in this special Indian Bureau class on the Brighton Seminole) Reservation in Florida.

Under most of the readjustment laws which have been enacted, th Secretary is authorized to undertake a special program of adult education and training designed to help members of the tribe to earn livelihood, to conduct their own affairs, and to assume their responsibilities as citizens without special services because of their status a Indians.

Under this authority the Bureau has contracted for appropriat terminal education programs for the west coast Indians and th Klamaths in Oregon, the four Paiute bands and the Ute mixed-bloo groups in Utah, and the Menominee Tribe in Wisconsin. In additio a limited program has been initiated under direct Bureau sponsorshi to accommodate the special adult training needs of individuals in th Wyandotte, Peoria, and Ottawa tribes in Oklahoma which are unde terminal legislation.

In-Service Training

To provide in-service training for education personnel at the operating level, area administrators, assisted by local and central offic technicians, conducted some 30 workshops during the year, in whic more than 2,000 employees participated. The participants came fro many areas, from Alaska to Cherokee, N. C., some assembling i large groups, others in small groups, but all for the same purpose—tha of seeking ways to improve all facets of the education progra provided for Indian people.

In addition to these local workshops an important conference o school administrators, technicians, and tribal representatives wa held in June to explore methods and techniques designed to raise th educational level of Indian people so that they can compete in th age of automation. In keeping with the Commissioner's policy o consultation with Indian groups, school officials were assisted an counseled by 17 tribal representatives. Minimum criteria for translating ideas into action were developed, educational policy for th various areas was drafted for approval through appropriate channels, and a collection of various opinions compiled relative to India needs.

Aids to Higher Education

In fiscal 1957 new scholarships for Indians were established by a number of private organizations and schools. Some tribal organizations also provided new scholarship grant programs while othe increased the amounts already authorized for this purpose. Th largest grant program was made by the Navajo Tribe, which estabned a $5 million trust fund, the income to be used for higher edu- ion grants. Since no income has been realized from this fund, the be has increased its present grant program to $200,000 for the fiscal ar 1958. The Bureau also continued making small grants to assist lified Indian youth in education beyond the high school level.

WELFARE

n 1957 there was increasing recognition of the need (1) for social vices on reservations to prevent breakdown in family life which tributes to child neglect and juvenile delinquency and (2) for rk with families toward self-support and improvement in stand- l of living through proper use of income. While financial assist- e to needy Indians remains a basic activity of the Bureau's wel- e program, there has been a growing demand for social services ed on the broader objectives of preventing family disintegration l dependency. Work has continued with the leaders of tribes eiving substantial income from tribal assets to develop programs ich will protect and conserve the income of minors and members o are non compos mentis or in need of assistance in managing ir affairs.

hile many Indians need help in establishing their legal status in tters of marriage, divorce, adoptions, and guardianship, and simi- relationships, this is particularly important in tribes covered by djustment legislation. Under terms of the legislation providing termination of Federal supervision over trust property of the lians of western Oregon and the Paiute bands of Utah, measures e taken under State law to protect the property of members who minors, non compos mentis, or in need of assistance in conducting ir affairs, prior to transfer or removal of restrictions from such perty. Effective action also is being taken within the terms of math legislation and the Uintah and Ouray Ute Tribes readjust- nt legislation over the affairs of the mixed bloods, to obtain pro- ion under State law for needy members of those tribal groups.

neral Assistance

n 1957 the general assistance program met increased needs in lahoma and the Southwest and in Montana due to severe drouth ditions. In Alaska referrals of tuberculous patients from the ited States Public Health Service continued and the case-finding rations of that agency resulted in a steadily high caseload consist- of dependents of hospitalized patients. Offsets to these increased uests for general assistance were found in the Northern Plains

States which again enjoyed mild winter weather. The general assi ance monthly caseload averaged 2,813 cases consisting of 7,548 p sons. The average monthly grant was $60.14 per household.

One noteworthy development was the increased responsibility sumed by the Navajo Tribe to meet relief needs of tribal membe Among the items provided were clothing for school children, em gency assistance, provision of housing materials for house repairs home additions and for medical appliances. A number of oth tribes with considerable resources continued to assume responsibili for financing the general assistance program for their needy me bers while some in the Dakota area continued to distribute surpl food commodities on their reservations.

Services to Children

Child welfare services of the Bureau have been aimed at providi for dependent or neglected children either in their own homes, or foster homes when placement outside the home has been indicate In 1957 emphasis was continued on planning for younger children remain in their own homes and attend public school, wherever poss ble, rather than enroll in Federal boarding schools. Social worke reviewed the situation of children already enrolled in boarding schoc and the applications for enrollment which were based on social rath than educational reasons to determine if the children could be assist to remain in their own homes or the homes of interested relative Through provision of aid to dependent children or other assistanc some children were enabled to remain with their families or relative Emphasis also continued on finding appropriate institutional care f children with handicaps, such as mental retardation, deafness, blin ness, or cerebral palsy.

RELOCATION SERVICES

Of the Indian people who applied in fiscal 1957 for relocation ser ices, 6,964 were assisted to relocate in six cities where the Bureau mai tained field relocation offices: Chicago, Ill.; Denver, Colo.; Los A geles, San Francisco and San Jose, Calif.; and St. Louis, Mo. Th total included 5,384 individuals in 1,302 family units, 1,166 una tached men, and 414 unattached women. This represents an increas of 36 percent over fiscal 1956.

Financial assistance was extended to 6,543 persons to cover all or portion of the cost of relocation. An additional 421 individua availed themselves of the employment and community adjustmen services but were not granted financial assistance.

n the reservation end of the relocation process, services were pro- ed at 43 agency jurisdictions, some of which served smaller nearby ncies on an itinerant basis.

he great majority of the relocated Indians are making satisfac- y adjustments in their new locations as evidenced by their many ers to relatives and friends back on the reservations. They have n assisted in securing employment with several thousand different ployers in diversified industries and have given satisfaction as rkers. The capabilities of Indian workers are becoming better wn and many employers are asking for additional people. Letters e been received from a number of employers testifying to their isfaction. This success in adjustment as employees has secured eptance of Indians as workers in some firms which had never em- yed Indians before, and has played an important part in broaden- the scope of the program.

t the reservations there continues to be a very active interest in ocation services. At most agencies there is a constant backlog of plicants waiting for assistance. Tribal councils, in general, agree t relocation service is a necessary function and one which provides he members of their tribes with a badly needed opportunity to gain ater economic security than is possible on the reservation. The vice is being accepted as one of the necessary tools with which each al group can work in planning a long-range program to help lian people to establish themselves as self-sufficient citizens.

LAW AND ORDER

he States of South Dakota and Washington both acted in fiscal r 1957 pursuant to Public Law 280, 83d Congress, to assume civil l criminal jurisdiction over Indian lands within their borders.

he South Dakota law provides that such jurisdiction will be as- ned or accepted only after favorable action has been taken by the rd of county commissioners of the particular county and after the nmissioners have negotiated a contract with the Bureau of Indian airs for reimbursement of the costs to the county involved. At sent the Bureau has no authority to participate in such a contract. is law also gives the Indian tribes of South Dakota one year from ober 1, 1957, in which to conduct a referendum on whether or not y wish the extension of such jurisdiction to their respective reser- ions. If they fail to hold such a referendum within that time, the nties may proceed to assume jurisdiction as provided in the law.

he Washington State law provides that the Governor shall, upon etition by the tribal council, proclaim the assumption of such isdiction. In the case of the Colville, Spokane, and Yakima res- ations, the tribal council petitions must also be supported by a favorable referendum vote of the membership at large. At the clo of this fiscal year two tribes not covered by the referendum prov sion—Muckleshoot and Skokomish—had petitioned the Governor Washington for the extension of State jurisidiction to their lands.

The San Carlos Apache Tribe was the only tribe to take positi action in 1957 to enact an ordinance to legalize intoxicating liquor a reservation. The resolution to put this into effect came in durir the closing weeks of the fiscal year and was not finally acted upc by June 30.

The staffing of the new positions, permitted by increased appr priations by the Congress, in the several areas for the maintenance law and order were mostly completed within the first quarter of tl fiscal year. This, together with more funds available for the care Indian prisoners and operating expenses, has substantially added better law enforcement on many reservations.

REALTY OPERATIONS

To attain greater efficiency in the trust supervision over India lands, the Bureau in 1957 moved forward with a reorganization c its realty activities in both central and field offices on more purel functional lines. This realignment, when fully established in all offices, will provide the basis for (1) facilitating the orderly withdrawa of Federal supervision over trust or restricted lands in accordanc with enacted readjustment legislation; (2) development of natura resources to maximum capacity while under trust status; and (3) development of full capabilities of the industrial, agricultural, recreational, and business potential of these lands to assume maximun compensable benefits while under Federal supervision.

Acquisition and Disposal

Major accomplishments under this heading in fiscal 1957 included (1) the purchase of a 98,000-acre tract in Arizona for use by th Navajo Tribe in connection with its ram herd development program (2) the determination of ownerships on a number of Californi rancherias in anticipation of readjustment legislation as sought b the Indians, and (3) the buildup of a realty staff at Palm Springs Calif., to work on the problem of equalizing allotments on the Agu Caliente Reservation.

During the year the Bureau processed a total of 10,243 realty transactions in compliance with requests made by the Indian owners Of these, 8,065 cases involving 325,314 acres resulted in removal of the lands from trust or restricted status. Supervised sales made at the request of the Indian owners, with the fee title conveyed to the on-Indian purchasers, accounted for 200,084 acres; issuance of fee atents (or unrestricted titles) to Indian applicants who proved their ompetency accounted for 91,344 acres; certificates of competency to ualified Indian applicants for 8,144; order removing restrictions as equested for 7,462; and other methods for 18,280.

In addition, 2,178 transactions were completed during the year hich had no material effect on the overall acreage of land in trust r restricted status. These included exchanges between individual ndians, between individuals and tribes, between Indians and non-ndians and partitions of allotments among several Indian owners. hese transactions, in part, assisted individuals in obtaining land for omes and blocking out economic and better units for operations.

enure and Management

Under this heading one of the important functions is processing equests for rights-of-way across Indian lands. In 1957 the Bureau rocessed 1,640 cases of this kind as compared with 1,448 in 1956. egulations governing the granting of powerline rights-of-way were odified during the year to facilitate the handling of cases where nes carry less than 33 kilowatts.

At the close of the year there were 31,366 leases or permits of all inds in force and effect on Indian lands, covering 3,423,911 acres and roviding an annual rental of $8,411,452 for the Indian owners. hese cover the use of Indian lands for farming, farm pasture, grazng, or business purposes. They do not include Indian lands incororated in range units. The long-term leasing act of August 9, 1955 69 Stat. 539), has brought about an interest in developing certain ndian lands where the cost of development could not be amortized nder the shorter tenure permitted by previous legislation.

With the steady growth of population in the United States and e consequent demand for new agricultural areas for development n the West, there has been a fairly uniform demand for the leasing f Indian agricultural lands, and a great many individual Indian eople for whom the United States holds lands in trust have derived substantial portion of their income, just as do their non-Indian eighbors, from the rentals of their lands.

Certain conditions, unique to the title patterns with which Indian llotments are encumbered, contribute in a large measure to the high ercentage of allotted Indian farmland used by non-Indians under eases. Because the United States has been required to hold title in ust for succeeding generations of heirs of original Indian allottees, large percentage, considerably more than half, of the allotments, re now held in multiple ownership. In extreme cases, the number f heirs may run as high as several hundred.

As a result, use of allotted lands by any one of the owners, where t title is thus complicated, is rendered exceedingly difficult because normal disagreement between the heirs and, further, because of la of adequate finances for any one of the heirs to acquire the intere of the other heirs or to pay a satisfactory rate of rental. Con- quently, most of the allotments in that status are leased to no Indians. This condition exists primarily throughout the Midw and the Northern Great Plains areas where a high percentage of t land has been allotted to individual Indians. Of the Indian lan classified as farmland, less than 30 percent (995,000 acres) is used Indians, and the balance (over 2,500,000 acres) is used by non-India under lease or permit.

This situation does not prevail to as great an extent througho the Southwest where most of the lands are still in tribal ownersh and where the lands are predominantly usable only for grazin Bureau records show that the Indians are using more than 33,200,0 acres of rangeland there and elsewhere throughout the Indian count as against non-Indian use of approximately 8,700,000 acres.

Minerals

The income received by Indians from the mineral leasing of the lands reached an all-time high of $75,592,015 in fiscal year 195 This was about $31 million or 72 percent greater than the amou reported in the previous fiscal year.

The proceeds from oil and gas leases amounted to $72,616,64 The outstanding oil and gas developments on Indian lands durin the year took place in the Four Corners area of Arizona, New Mexic Utah, and Colorado. Advertised sales of leases on Navajo lands i this area brought nearly $35 million in bonus payments. In additio the Ute Indians in Colorado and New Mexico portions of the Fou Corners realized about $12 million in bonuses. These bonuses alon exceeded the entire income from oil and gas operations on India lands for any preceding year.

In addition, there was extensive development during the year o the Jicarilla Reservation in New Mexico largely as a result of ga pipelines to California and the Pacific Northwest. Indian lands i Oklahoma continued to lead in oil and gas production. Oil and ga development on Indian reservations in Montana and Wyoming remained comparatively steady.

The total income from oil and gas on all Indian lands was compris of the following items:

Bonus received from lease sales	$49, 548, 74
Royalties on production	18, 492, 43
Annual rental for lands held under lease	4, 575, 46

The total income for minerals other than oil and gas amounted $2,975,371. On the San Xavier Reservation, Arizona, a high bid slightly in excess of $1 million was received for three preferential ospecting permits. The interest in uranium development in Arina and New Mexico continued steady. The Jackpile uranium mine the Laguna Pueblo, one of the largest uranium mines in the United ates, brought a royalty income of approximately $2,066,503 to the ieblo. Lesser incomes were realized from lead and zinc leases on e Quapaw Reservation, Oklahoma, and from phosphate leases on e Fort Hall Reservation, Idaho.

IRRIGATION

During fiscal 1957 approximately 4,800 acres of land were provided th new irrigation facilities and an additional 7,000 acres were proded with a stable and supplemental water supply through the rebilitation of previously constructed systems. The work during e year involved the drilling and equipping of six new irrigation ells; the rehabilitation of 19 old wells; the drilling and equipping 4 wells for combined irrigation and domestic water purposes; the nstruction, extension, rehabilitation, and replacement of 564 miles canals and laterals; the concrete lining of 6.2 miles of laterals; e replacement, construction and rehabilitation of 1,090 structures of rious sizes and types; the installation of 14,920 feet of steel and ncrete pipeline; the excavation of 28 miles of drainage canals; e replacement of one 650-foot-long siphon; the installation of one 0-foot, 24-inch flume; and the realignment of approximately 5 miles river channel. One large wasteway structure was completed and e is about half complete. In addition to the foregoing irrigation velopment work, 55 miles of power transmission and distribution nes were extended and replaced to serve an additional 256 customers the Colorado River, Flathead, and San Carlos projects. Crops oduced on the various projects during the calendar year 1956 were lued at $55,265,484.

The more important irrigation developments during the fiscal year 57 were as follows:

olorado River Project, Arizona

The overall development program on the Colorado River Resertion involves the expansion of the irrigation project to its ultimate ea of 100,000 acres. During fiscal 1957 intensive and comprehensive surveys, investigations and studies were continued for the extensi of the lateral and drainage systems. The construction of the Post wasteway was started and about half finished. Other work consist of enlarging and deepening existing drains and the extension of t power system approximately 3 miles.

San Carlos Project, Arizona

The extreme drought conditions experienced on this project ov the past several years continued in fiscal 1957. Work on the proje involved primarily the drilling and equipping of new wells and t rehabilitation of existing wells.

Fort Hall-Michaud Division, Idaho

This project was authorized under the act of August 31, 1954 (6 Stat. 1026). Construction by contract was started on this unit i fiscal 1957. The unit will eventually embrace 21,000 acres and is e pected to cost about $5,500,000.

Flathead Project, Montana

The work on this project consisted primarily of the continuation o the concrete lining of the Dry Creek, Polson pump and feeder canal

Middle Rio Grande Pueblos, New Mexico

The land development and irrigation rehabilitation work authorized under the Flood Control Act of 1948 and its supplemental act o 1950 for the Pueblos within the Middle Rio Grande Conservancy District was started during fiscal 1957.

Engineering Plans and Surveys

In addition to the actual development work on the various projects and the regular preliminary and preconstruction surveys, the Burea also undertook several other tasks of a planning nature. These included surveys and investigations for rehabilitation and extension o the Pine River project in southern Colorado; initiation of preliminary surveys on Indian lands within the proposed Florida and Animas-LaPlata projects in northern New Mexico; and a considerabl amount of work on the Navajo project consisting of investigations and planning incidental to the preparation of a supplemental report to the feasibility report dated January 1955.

FORESTRY

Noteworthy features in Indian forest management during 1957 inluded the receipt of a record-high income from the sale of Indian imber, an increase in funds provided for forest management, and he development of new procedures for recruiting forestry personnel. orest management was also affected by the publication of a joint ongressional committee report on “Federal Timber Sales Policies,” nd by another Senate committee’s searching review of forest mangement practices on the Quinault Indian Reservation in Washington tate.

Income from the sale of Indian timber during calendar 1956 exeeded $14 million, an increase of 23 percent over the former record hat was established in 1955. This income includes the value of tumpage used by three tribal sawmill enterprises. The greater inome was received despite a 5 percent falloff in volume of timber sold.

There has been a general upward trend in the volume and value of ndian timber sales during the past decade. This trend is in harony with the objective of placing all Indian forests in full producion under sustained-yield management. In working toward this bjective, the Bureau initiated several years ago a plan to inventory he Indian forests of commercial importance and, with these invenories, to recalculate the growth potential and allowable annual cut. his program was continued successfully in 1957. At the present ate of progress, acceptable information for all Indian forests of ommercial importance should be available within the next 5 or 6 ears.

The increasing volume of timber sale business has required an inrease in forestry personnel. Furthermore, the competitive demand or timber offered for sale has substantially increased the prices beng received for it. With the increase in value has come the need of ore careful supervision of sales. This requires more man-years f effort in supervising the sale of a given volume of timber. Other orest managing agencies are faced with similar problems and, as a esult, personnel recruitment difficulties have multiplied. The probem was partially solved during the past year, in cooperation with he Civil Service Commission, by raising the entrance salaries in the wo lower grades, and through simplified recruiting methods.

RANGE, WILDLIFE, AND RECREATIONAL RESOURCES

The Indian range land is divided into range units and made availble for use under permits which describe the maximum stocking, the roper season of use, and the conservation requirements necessary to obtain the maximum use consistent with sustained forage produ tion. The range land not needed for Indian use is offered to no Indian operators on a competitive-bid basis.

Proper use of the range has been and continues to be a difficult on large areas of tribally owned ranges in New Mexico and Arizon In 1957 the San Carlos Apaches of Arizona passed a range ordinanc which will assist in obtaining proper use. The attitude of the I dians is changing toward proper use where sufficient personnel an training aids are available to bring their attention to the need o maintaining the range resource.

TABLE 1.—*Range land use, 1956*

	Acres	Percent	Cattle units	Percent	Value
Total range	44, 000, 000	100	886, 000	100	$6, 293, 0
Total use	41, 900, 000	95	874, 000	99	6, 293, 0
Non-Indian use	8, 700, 000	20	334, 000	38	2, 147, 0
Indian use	33, 200, 000	75	540, 000	61	4, 046, 0
Not used	2, 100, 000	5	12, 000	1	

NOTE.—Total number grazing permits: 13,200.

Fish, wildlife, and recreation are gaining impetus on many of th Indian Reservations. Some of the tribes are beginning to realiz that they have an excellent resource in demand by the public. Con tinued guidance in developing this resource will assist some of th tribes in obtaining returns from a resource which had been use only by individual Indian members.

TABLE 2.—*Fish and Wildlife—approximate income or value of 1956 harvest*

Total all reservations	$2, 220, 00
Commercial fish	461, 00
Domestic fish	421, 00
Fur bearing animals	148, 00
Game birds	195, 00
Big game	920, 00
Receipts from permits (fishing and hunting)	75, 000

SOIL AND MOISTURE CONSERVATION

In 1957 soil and moisture conservation work on Indian land had its best year since the program started in 1940. This is evidenced by the fact that 2,423 educational meetings on soil conservation were conducted with 72,017 Indian people attending. As a result of these meetings, 11,287 land use plans were developed covering 4,953,040 acres of farm and ranch land. To provide more grazing for livestock, brush was eradicated on 97,725 acres; seeding and sodding were accomplished on 159,018 acres and waterspreading on 52,385. Under the drought conditions, which have prevailed for the past several years over much of the West, waterspreading has increased forage production ten times and more on areas where water was diverted from arroyos to adjacent parched range land.

The watershed protection program has been accelerated by the building of 1,020 detention dams, 56 miles of dikes, 800 diversions, 431 miles of terraces and bank protection work on 135 miles of stream to help prevent damage by rampant flood waters.

Development of the Indians' cultivated lands continued at a rapid pace during the year. Greater emphasis was placed on the use of vegetation to improve yields, conserve moisture and control wind and water erosion. Cropping systems on 2,939,419 acres served to improve the physical condition of the soil, add organic matter and rotate crops, thus providing greater infiltration of moisture, less runoff and greater yields. Residue management on 675,796 acres and strip cropping on 454,272 acres provided cover and protection from wind and water erosion. For additional ground cover and soil improvement, cover crops were used on 230,709 acres. To assure a good growth of soil improving and cover crops, 25,876 tons of fertilizer were applied.

This combination of vegetative conservation measures with mechanical measures such as terrace and contouring is essential to economically sound conservation farming.

One of the most important phases of the Bureau's soil and moisture conservation program involves the eradication of rangeland brush. Thousands of acres of Indian land in the United States are infested with brush that has little or no economic value and competes with the more desirable plants for available water and plant nutrients. It has been found that approximately seven times as much forage is produced in areas where the juniper and other undesirable brush have been removed as in areas that have not been treated.

One of the biggest brush eradication projects is on the Fort Apache Reservation in Arizona, which is heavily infested with juniper. The cost of treating juniper at Fort Apache has decreased from year to year as new and improved methods have been put into effect. In 1957 the cost per-acre for the eradication of juniper for all methods used (including burning, dozing, cabling, and hand chopping) amounted to $5.83. Since the program was started in 1940 approximately 139,990 acres of juniper have been eradicated on the reservation. In 1957 the Bureau spent $37,900 of soil and moisture conservation allotments and the Fort Apache Indians spent $143,000 of their money in the juniper eradication program.

The Bureau is continuing to foster cooperation with the various soil conservation districts. During the past year an additional 114,304 acres of Indian land was included within soil conservation districts by formal agreements.

Indians are very anxious to promote soil conservation work on their land, and in many soil conservation districts one or more Indians are serving as district supervisors. In areas where soil conservation districts do not exist, Indians have organized their own soil conservation enterprises and associations to promote the conservation work on their lands. Altogether 21,345,691 acres of Indian land in 17 States and on 65 reservations are now covered by formal cooperative agreements with 176 soil conservation districts.

AGRICULTURAL EXTENSION

Apart from the States of Arizona, New Mexico, and Mississippi where the Bureau is still responsible for direct extension work with Indians, this activity is now being conducted by State agricultural extension services under contractural arrangements.

Progress was made during fiscal 1957 in improved irrigation practices and introducing better production practices on farm lands, as well as in getting more acres into production which have not been in use. Extension educational activities designed to improve practices in management, breeding, and marketing of livestock were also stressed.

In this process, Bureau extension workers held or participated in 3,182 meetings with an attendance of 102,364 people; made approximately 14,381 farm calls; made 73 radio and television program presentations; wrote 79 news articles, and distributed 10,335 bulletins. Programs stressed the marketing of cattle through local livestock auctions, internal and external parasite controls, ram selections, wool marketing, culling of herds and poultry raising.

Although it is very difficult for the home demonstration agents to know accurately the number of women adopting practices due to the mass media methods employed, it is estimated that a minimum of about 7,500 Indian housewives were influenced to adopt new practices in home management, family economics, clothing, foods and nutrition, health, family life and safety.

On the youth side there were 91 Indian 4–H clubs with 569 boys and 873 girls active in 1957. Of this group 398 boys and 646 girls completed their project requirements.

ROADS

The 1957 Bureau road program was authorized in the Federal-Aid Highway Act of 1954. The act included an annual contract authorization of $10 million for road construction and maintenance during the 1955, 1956, and 1957 fiscal years.

The $2,300,000 maintenance part of the program provided routine maintenance on about 18,000 miles of reservation roads and bridges in 23 States. The road maintenance program in the State of California continued special repair work due to the damage caused by the heavy floods in 1956.

The Bureau's road system was reduced by 415 miles in 1957 in line with the policy of constructing roads to an adequate standard under an agreement with the local government that it will then take the road into its system and be responsible for maintenance. An increase of 886.7 miles on the Navajo Reservation system is needed because the greatly increased Navajo educational program has created a need for more access and school bus roads to serve the many new school locations.

A total of $7,700,000 was available for the 1957 road construction program. Chief accomplishments included 480 miles of grading and draining, 470 miles of gravel and bituminous surfacing, 941 feet of bridges, and survey and plan work for future projects.

CREDIT ACTIVITIES

Financing is required by the Indians to develop and utilize their resources, both physical and human. The Bureau's credit program is designed to help Indian people in meeting these needs.

Primary emphasis in the Bureau's credit operations is placed upon securing financing through customary channels. Secondary emphasis is placed upon financing by the United States, and by tribes and other Indian organizations.

Financing Through Same Credit Institutions Serving Other Citizens

The following is a summary of the estimated financing received by Indians from non-Bureau lenders during the past 4 calendar years:

Calendar year:	
1953	$27,665,000
1954	33,960,000
1955	55,725,000
1956	59,425,000

The amount of outside financing for 1956 shows an overall increase of $3,700,000 from the amount estimated to have been received in 1955.

Public Law 450 (approved March 29, 1956), which authorized the execution of mortgages and deeds of trust on individually owned Indian trust or restricted land, has been of assistance in enabling additional Indians to obtain justified financing from the same financial institutions serving other citizens. They are now in a position to utilize their chief asset, land, as security for loans. To indicate the trend in this respect for the past 3 calendar years, the following is summary of the totals, on a cumulative basis:

Calendar year:	*Number*	*Amount*
1954	36	$143, 600
1955	56	269, 900
1956	86	475, 600

Financing Through Bureau of Indian Affairs

The main volume of financing for which the Bureau has responsi bility is actually accomplished through tribes and other Indian or ganizations. Two main funds are involved, (1) tribal moneys, anc (2) a revolving loan fund appropriated by the Congress. In additio to the active programs of the Bureau, two old credit programs are i process of liquidation, (1) so-called "reimbursable" loans which originated in (*a*) appropriations by the Congress during the years 1911–43, inclusive, for the purpose of encouraging industry and self-support among Indians, and (*b*) appropriations of funds held in trust in the Treasury for various Indian tribes for tribal industrial purposes, and (2) loans of livestock repayable "in kind".

The following shows the amounts involved in the Bureau's program at the close of the past 4 years:

	1953	1954	1955	1956
Tribal funds	$9, 704, 611	$9, 669, 468	$17, 300, 578	$21, 216, 542
Revolving fund loans receivable	10, 190, 941	9, 505, 193	8, 311, 374	7, 715, 612
Reimbursable [1]	988, 007	841, 568	498, 299	314, 040
Livestock loans [2]	[2] 1, 834, 415	[2] 1, 433, 575	[2] 1, 039, 445	715, 105
Total	22, 717, 974	21, 449, 804	27, 149, 696	29, 961, 299

[1] In process of liquidation.

[2] Figures differ from those previously published because of revaluation of livestock at estimated market value of $55 per head in order that data may be comparable.

Use of Funds by Relending Organizations

Tribes and other Indian organizations use revolving funds borrowed from the United States and tribal funds to finance tribal business enterprises, to make loans to cooperative associations of members, and to make loans to individual members. At the close of 1956 nearly $16 million had been loaned and invested in tribal business enterprises, nearly $640,000 was outstanding in loans to cooperative associations, and nearly $7,200,000 outstanding in loans to individuals. Indian organizations were carrying over $6,600,000 in cash for operation of enterprises and for loans.

Balances outstanding at the close of the past four fiscal years were s follows:

	1953	1954	1955	1956
nterprises	$9,026,322	$8,913,728	$14,232,917	$15,949,360
ndividuals	8,861,220	8,562,825	7,521,799	7,182,471
ooperatives	149,974	136,650	161,177	639,375
Total	18.037,516	17,613,203	21,915,893	23,771,206

As of June 30, 1956, $956,989 was delinquent on loans made to en- erprises. Over 50 percent of the delinquent amount was on enter- rises in Alaska. Four salmon canneries financed with loans through he Bureau have not, on the whole, been profitable. Special efforts ave been made to place these enterprises on a sound operating basis uring the past 2 years, and some improvement has been made as a esult of corrective measures taken. The canneries had a deficiency of 632,221 for the fiscal year ending March 31, 1954, which was reduced o $495,466 for the fiscal year ending March 31, 1956. For the first ime since the four canneries were acquired, all four recorded a profit or the fiscal year ending March 31, 1956.

Of the balance of $639,375 unpaid on the loans to cooperatives at he close of the fiscal year, $50,857 was delinquent or owing on loans n process of liquidation. Of this amount, $44,386 is due on loans made y the United States many years ago, and will have to be charged off s uncollectible.

During 1956, a total of 1,160 cash loans totaling $1,758,759 were nade to individuals, compared with 1,008 loans of $1,593,184 in 1955. he actual increase was greater than is indicated by these figures, ince during 1955, three tribes for which readjustment legislation was nacted (Menominee, Klamath, and Ute) made 107 loans totaling 184,060. These three tribes made no loans in 1956. Apart from these hree, other tribes and organizations recorded an increase of 28.75 per- ent in the number of loans made, and 24.81 percent in the amount oaned to individuals, over the number and amounts loaned in 1955.

The repayment record on individual loans at the close of 1956 was n need of improvement. A total of $1,885,895 of the unpaid balance f $7,182,471 was either delinquent or owing on loans in process of iquidation, compared with $1,481,358 at the close of 1955.

In addition to cash loans made to individuals, there was an esti- nated $1,833,747 outstanding in loans made by Indian organizations epayable "in kind" at the close of 1956.

ARTS AND CRAFTS

The Indian Arts and Crafts Board has the responsibility of promoting the economic welfare of Indian people by educating the craftsmen in modern commercial methods, fostering high standards of quality and protecting both the consumer and producer from cheaply imitated wares.

Interest in Indian arts and crafts is increasing, not only among the public at large, but among the Indian people themselves as they realize more and more that this is an important part of their life and culture, and a significant source of livelihood. In many cases, income from arts and crafts sales is supplemental; in many others, it represents the only cash income received by the craftsmen.

The Board has continued to encourage the development of Indian owned and operated production-sales organizations through which the Indians are taught modern commercial methods without "commercializing" their products.

The several crafts groups in Alaska are continuing to make progress. Plans are now under way for further development and expansion with assistance from the Alaska Rural Development Board. A new project has come into being at Kivalina where Eskimo craftsmen are fashioning distinctive items of jewelry from caribou hoofs. These items have been on the market in limited quantity for the past several months. Sales have been excellent and there are plans to expand the project in fiscal 1958.

For the first time in several years, one of the regular quarterly meetings of the Board was held with the Seminoles in Florida. The Seminole Crafts Guild is a small but successful business enterprise. However, it was found there is still need for close supervision until the Seminoles are able to manage it for themselves. It is planned to put a full-time arts and crafts specialist on duty there.

The Qualla Arts and Crafts Mutual at Cherokee, N. C., has continued its successful operation. Membership in the organization is growing. The group is now beginning to think in terms of expansion and it is hoped that definite plans for enlargement will soon be developed.

The Oklahoma Arts and Crafts Cooperative at Anadarko is a new venture which started in 1956. While progress in fiscal 1957 was somewhat slow, the members are working hard to make the organization a success and are expected eventually to succeed.

At Rapid City, S. Dak., the Sioux Indians Exhibit and Craft Center is continuing to prove an effective instrument in serving the Indian citizens of the area as well as the community in general. In addition to the activities at the Center, the director continued to give assistance to craft groups at Rosebud, Tama, Pipestone, and Cheyenne River.

The Board published a business booklet for Indian artists and craftsmen which has now been widely distribtued. Comments received indicate that it is proving to be a worthwhile and useful publication.

PLANT DESIGN AND CONSTRUCTION

The Bureau's work in plant design and construction was substantially increased in fiscal 1957, requiring a reorganization of the staff and a material increase in the number of employees. This increase in work was brought about by several factors. The two most important factors were the accelerated educational program and a new policy in planning Bureau construction.

Plant design and construction work is tied in with the educational program on both a long-range and an immediate basis to provide school buildings, dormitories, kitchen-dining facilities, housing and other buildings required for educational purposes. While the funds provided for actual construction during fiscal 1957 were not unusual, this was the first year in which the Bureau received funds to do advance planning of projects to be financed from future appropriations. A total of $539,600 was provided to make site surveys, prepare project requirements, and contract with private architect-engineers to design the required facilities and develop drawings and specifications for their construction. In accordance with the Bureau policy of contracting with private architects and engineers to design and prepare plans and specifications for all major projects requiring new plans, contracts were negotiated for and award made covering 9 projects at a cost of approximately $92,230 for architect and engineer services. In addition, Bureau architects and engineers adapted plans and specifications previously used on similar structures so that they could be used on 16 projects which are estimated to cost $1,808,000 for final construction. These advanced planning projects when complete will provide educational facilities for 185 children not now in school.

Construction was completed on 22 general contracts, with total contract and related costs of approximately $2,381,232; and on two force account projects at a cost of approximately $382,500. The completed work will provide additional facilities for 728 additional children, and improve health and sanitary facilities at 7 locations.

Work was in progress during the year on 37 projects estimated to cost approximately $5,343,000. When complete, they will provide educational facilities for 726 additional children and improve Bureau facilities at 29 locations.

PLANT MANAGEMENT

The Branch of Plant Management, newest of the Bureau's branches, was established under the Assistant Commissioner, Administration, by Commissioner's memorandum dated February 1, 1957, with responsibility for all functions comprising plant management including those formerly designated as maintenance of buildings and utilities.

Each area office was instructed to establish a similar unit under the Assistant Area Director for Administration.

In order to provide engineering guidance to the Bureau's programs in the field, a technical staff consisting of an electronics engineer and a mechanical engineer has been located in Albuquerque, N. Mex., where they will be available to assist all areas, including Alaska, on technical matters pertaining to communications and mechanical installations. Their primary functions, however, will be to analyze the operation, maintenance and plant management activities of the Bureau's installations, to promote the most effective methods of operation and maintenance, and establish adequate operating and maintenance standards throughout the Bureau.

PROPERTY AND SUPPLY

The Bureau's continuing study of its operations that may be in competition with private enterprise resulted in the closing of more laundries and bakeries in 1957. Services and products are now obtained commercially. Several bakery facilities will be operated as pastry shops for local requirements of certain schools in conjunction with, and as part of, the operation of the school kitchens.

In accordance with the act of May 20, 1948 (62 Stat. 248), certain land excess to the Sioux Sanitorium in South Dakota has been sold to various church organizations in Rapid City. In view of the interest of the Department and the Bureau of the Budget in the real property disposal program, the remaining land will be declared to the General Services Administration for disposition.

The declaration to General Services Administration of excess lands in other areas has been accelerated and the Bureau looks forward to even better progress in utilization of real and personal government property.

General Services Administration continues to establish motor pools throughout the country in certain large cities and surrounding areas. The Bureau is taking advantage of this program for acquiring its transportation needs wherever pools are available.

Employees' quarters have been revaluated and rates established in accordance with directives of the Bureau of the Budget.

During the year 444 cubic feet of records of the Central Office were transferred to the Federal Records Center at Alexandria, Va. This transfer released 245 square feet of floor space which was subsequently utilized for offices and personnel.

The time limitation on material which may be included in a Central Office file was recently reduced from 10 years to 5 years in order to facilitate the handling of files which have been transferred to the Center.

BUDGET AND FINANCE

Continued progress was made during 1957 in revising and improving the accounting system installed in Bureau accounting offices in fiscal year 1953 to better meet budgetary and program needs.

Studies are continuing to further improve, strengthen, and simplify budgetary and accounting requirements (including studies for further mechanization of the accounting work in the area offices) as well as to simplify the reporting requirements. Approval was granted the Portland area office to install an IBM accounting system beginning July 1, 1957. The machine accounting will be performed by the Bonneville Power Administration on a special reimbursable operation at an estimated cost of $750 per month to the Bureau. It is estimated that this procedure will save approximately two man-years in the accounting section of the Portland area office.

Procedures were initiated to place trust individual funds in banks thereby currently obtaining greater interest yield for individual Indians than has been obtainable through Treasury bonds.

INTERNAL AUDIT

During 1957 Bureau auditors, working out of two audit field offices —one at Albuquerque, N. Mex., and one at Billings, Mont.— audited all of the Bureau's 10 areas and the Central Office. In addition four of the Bureau's 6 field relocation offices were audited and several special audit assignments were completed.

INSPECTION

The Bureau's inspection program was established early in March 1955. Since that time inspection personnel have spent a considerable amount of time in the field, visiting area offices and various other installations. Nine of the 10 area offices have been visited, some on more than one occasion, in connection with matters of inspection interest. Primarily the inspection office is responsible for the conduct of "incident-type" inspections, general inspection inquiries and team surveys. The objective of inspection is to promote and encourage high standards of conduct in the management of Indian Affairs throughout the Bureau's operations in line with announced Departmental policies.

MANAGEMENT COORDINATION

Organizational Changes

Only one significant organizational adjustment was effected in the Bureau in fiscal 1957. As reported above, a branch of Plant Management was created in the Division of Administration to provide specialized technical assistance in the operation, maintenance, repair and improvement of Bureau plant facilities. The new branch was created in response to the present and projected expansion of the Bureau's construction program for schools, dormitories, heating and power plants, water systems, and fixed equipment.

At the same time the Branch of Buildings and Utilities, located in Albuquerque, N. Mex., was redesignated the Branch of Plant Design and Construction.

Mechanized Procedures

The Bureau has moved forward energetically in its exploration of applications of punchcard procedures in several diverse fields.

The experimental enumeration of the Indians in the Aberdeen area has been completed, revealing information which has never before been available in quantity on such items as individual incomes, family status, occupations, and residences. Experience gained on this enumeration will be used in a census of the huge Navajo Reservation, to be undertaken in the near future.

Mechanized procedures also have been applied in almost all areas to account for nonexpendable property. By utilizing tabulating cards excess property becomes readily apparent, accounting is simplified, and better utilization of Government property may be achieved.

A pilot installation of mechanized financial accounting procedures is being conducted in the Portland area office and consideration will be given to bureauwide extension of the system. A selected number of tribal rolls have been converted to punchcards resulting in easier and more meaningful analysis of the information contained therein.

Reports and Forms Management Program

During the first year of operation 533 forms were reviewed under the forms management program, resulting in the elimination of almost 50 percent and the revision of 22 percent of the remainder. Forms surviving this preliminary review are subject to further study when reordered.

Since the completion in July 1955 of the reports survey which was authorized by the 83d Congress under Public Law 663, the Bureau's reports management program has eliminated 35 percent of the reports inventoried under the survey. More than half of the 121 current reports are required by outside agencies, only 55 being used for Bureau purposes alone.

Report data, field study results, and data on population, land, budget, personnel, and programs have been gathered in a central unit. The results have been better and more accurate information, faster and more detailed answers to inquiries, and valuable management studies made possible by the readily available data.

Administrative Issuance Review

Moderate progress has been made in the review, revision, and coordination of CFR, published delegations of authority, Indian Affairs Manual and other administrative issuances.

New instructions governing the preparation and distribution of the Indian Affairs Manual were published. The new instructions prescribed a simplified format and numbering system and improved coordinative procedures.

Incentive Awards Program

Participation by Bureau employees in the incentive awards program increased markedly during the fiscal year. The number of suggestions for improving operations totaled a record 326—a 300-percent increase over fiscal 1956. Also, the quality of suggestions improved as the ratio of accepted suggestions to those received rose from 18 to 35 percent. The accepted suggestions represented an estimated $22,221 savings to the Government.

PERSONNEL

A supervisory training program was initiated in 1957 for all supervisors at all levels. The contents of the program include training in human relations, related special subjects, organization interrelationships, and self-improvement. Sessions for supervisors are conducted each month at the various local, area, and Central Office locations. The junior internship program has been amended to include positions of a professional and technical nature at the entrance level. The broadening of this program affords more opportunity for all Bureau functions to take advantage of this type of training.

BUREAU OF LAND MANAGEMENT

Edward Woozley, *Director*

PUBLIC LANDS

THE BUREAU of Land Management was established as the Department's chief custodian of the public domain on July 16, 1946, when the General Land Office (established in 1812) was consolidated with the Grazing Service (created in 1934) under the provisions of the President's Reorganization Plan 3 of 1946.

The Bureau exclusively administers approximately 468 million acres of public domain lands, about 290 million acres of which are in Alaska. Most of this land is unappropriated and unreserved.

BLM also manages the mineral resources in about 58 million acres of lands now in private ownership, in which the Federal Government has retained the mineral rights, and many million acres of submerged lands in the Outer Continental Shelf.

In addition, the Bureau manages the mineral resources in another 242 million acres of federally owned lands whose principal management responsibility rests with other agencies, such as the administration of mining on the national forests of the Department of Agriculture.

Still another management responsibility of the Bureau of Land Management is what are known as acquired lands—some 58 million acres that come into federal ownership through purchase, exchange, transfer, condemnation, or donation.

Functionally, the Bureau of Land Management manages, conserves, and under a policy of development through wise use, manages the land and its natural resources, including the range grasses and other forage, the minerals (including oil and gas), and timber.

These activities fall principally into five categories—lands, minerals, range, forestry, and cadastral engineering.

Principal accomplishments for the fiscal year ending June 30, 1957, in these activities are summarized in the following pages.

LANDS

All lands activities of the Bureau of Land Management have been influenced by the increasing demands upon the Nation's public lands and their resources.

In the expanding economies of the public land States, new patterns of growth are being shaped by rapid population increases, industrial expansion, increased mobility afforded by superhighways, rising incomes, and more leisure time.

The small tract program in southern California is a dramatic example of changing patterns of land use. Desert hinterlands of Los Angeles and other urban centers, considered of marginal value except perhaps for limited grazing in recent years, are now being sought for rural homes or permanent residences. Prices recently paid for these lands have been as high as $500 per acre.

To meet the demand for lands, the Bureau has found it necessary to institute every possible means to improve operations and program efficiency.

Lands Legislation

Several legislative matters of importance to land management programs have been under consideration by the 85th Congress. While these measures were not enacted into law by the end of the fiscal year, they had received favorable action from congressional committees.

One bill would provide that future applications for withdrawals or reservations of more than 5,000 acres for defense purposes would not become effective until approved by act of Congress, indicating the concern of the Congress over the multiple demands for public lands. The bill passed the House in the closing days of the 84th Congress, but was not acted upon by the Senate before adjournment. The Department has suspended action on applications for this type of withdrawal pending action on the similar bill which was introduced in the 85th Congress. The legislation has several features including safeguards to insure that minerals in reserved public lands remain subject to the public land mineral laws and that to the maximum extent surplus withdrawn and reserved lands are returned to the Department of the Interior for disposition under the public land laws.

Another important bill would grant Alaskan tidelands adjacent to surveyed townsites abutting tidewaters to the Territory. At present, permanent development cannot proceed on such lands owing to the fact that they are being held in trust for the future State of Alaska. Since many tidewater communities can expand only seaward, the Department has sponsored this legislation.

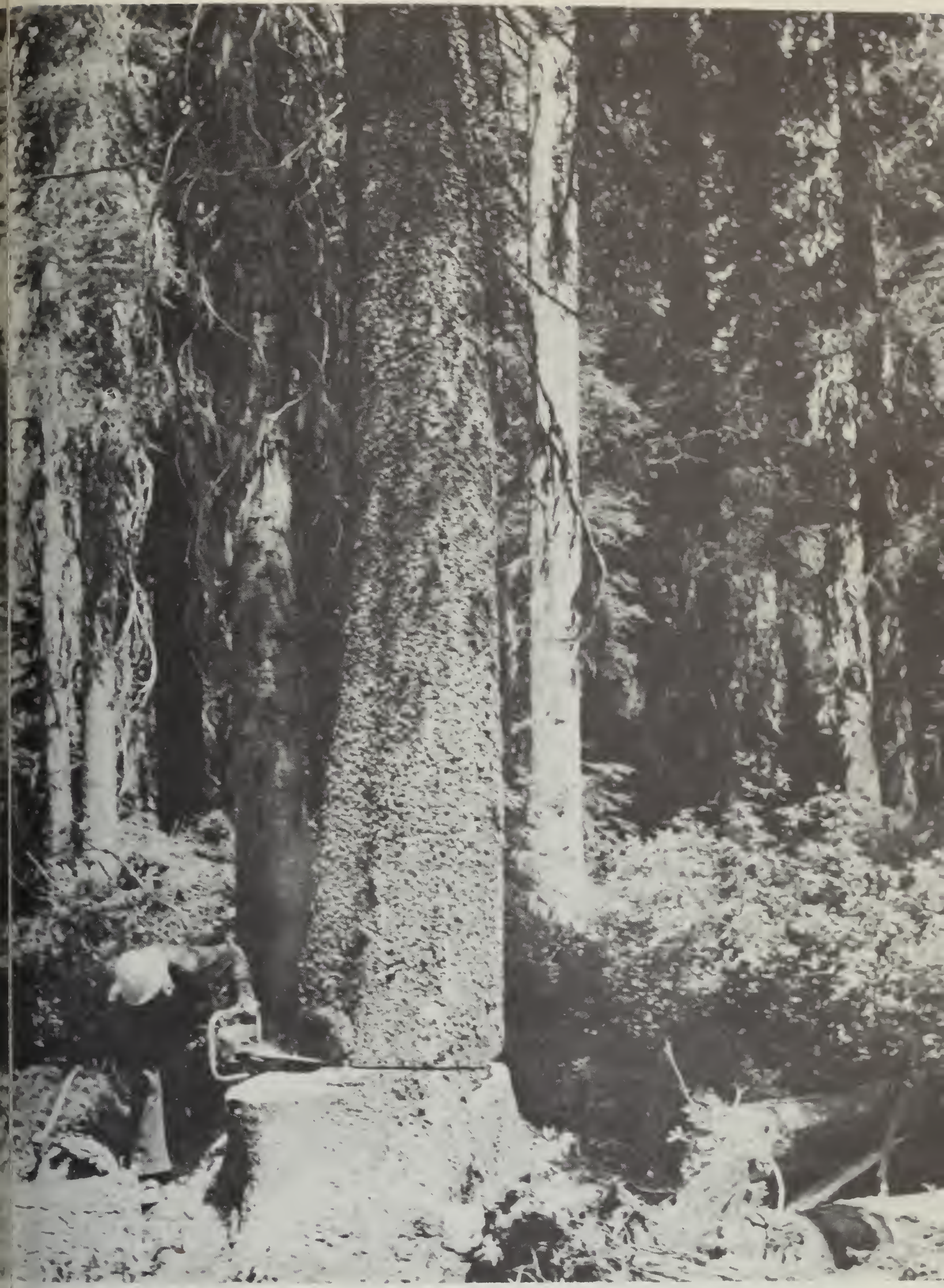


Figure 24.—O. and C. timber—Whether in selective cutting or clear cutting, sustained-yield management is the key to wise use of the timber resources of the vast forests and woodlands under the Bureau of Land Management's special jurisdiction.

Other Alaska legislation would permit the Territory to select lands covered by mineral leases in satisfaction of its grant of lands under the Alaska Mental Health Act. The Congress has under consideration additional land-grant legislation. Enactment of Public Law 507 (84th Congress) authorized the Bureau of Land Management to construct and maintain campsites and other recreation areas in Alaska, and to transfer them to the Territory for operation and maintenance. Amendment of this act to clarify its terms to make clear that it authorizes conveyance of title to improved recreation sites to the Territory has been proposed.

Indicative of the ever-growing problems of multiple use and intensive utilization of the public lands are the many legislative proposals which the Bureau had occasion to consider or comment upon during the year. These included the following subjects among others; the 640-acre limitation in the Recreation and Public Purposes Act; extension of the Recreation and Public Purposes Act to the O. and C. lands; creation of a wilderness preservation system; provision for the bulk sale of lands in Nevada to the Colorado River Commission of Nevada; recreational policy for public domain forest and woodlands; townsites in national forests, and for the other public land areas; and rights-of-way in national forests.

Regulations and Procedures

A corollary of the Bureau's continuing program to modernize the public land laws is the revision of the regulations. Regulations, issued by the Secretary, inform the general public of its opportunities, rights, and privileges under the public land laws. Operations of the Bureau are correlated with new legislation and regulations through issuance of policy statements and manual procedures. It is the responsibility of the Director's staff to provide these working tools to field officials.

The act of September 3, 1954 (68 Stat., 1146), provides the statutory authority for the Department to issue leases, permits, or easements to public agencies for the construction and maintenance of public works on lands it administers. During the year the Bureau drafted and the Department approved regulations to implement this act. Prior to enactment of this legislation, Federal land utilization programs were impeded by the lack of general authority to grant public agencies the tenure they often needed in Federal lands. The guarantee of tenure provided by Public Law 771 will permit capital investment in desirable public improvements on the public lands.

Other new regulations which have been issued pertain to veterans' rights and privileges (43 CFR 181), sales for public purposes and rights-of-way in trustee townsites in Alaska (43 CFR 80), and applications for withdrawals and reservations (43 CFR 295). The latter places all withdrawal actions on the same basis, requiring an application for withdrawal in each instance, providing for segregation of the lands pending action on the application, and requiring publication of each application. The regulations stemmed chiefly from the increasing competition for public lands and the resulting need for procedures insuring full consideration of all the interests and problems involved. To this end, provisions are made for hearings when indicated and careful scrutiny of all applications by this Bureau with a directive to the Bureau for negotiations with applicants to keep all withdrawals to a minimum and to maximize multiple use.

Twenty-three releases for the lands volume of the Bureau of Land Management Manual were issued during the year. These ranged from minor revision of forms to complete procedures for handling various types of applications under the land laws. Procedures governing conduct of public sales of small tracts, procedures for the suspension of homestead (and desert land) entries under Public Law 834 (act of July 30, 1956, 70 Stat. 716), and samples of the proper form for public land orders were issued through Manual releases. Rules governing public relations in connection with field examinations were also issued in a Manual release.

Lands Adjudication

New applications received for the use or acquisition of public lands totalled 23,000 in fiscal year 1957, about the same quantity received in 1956, despite the fact that large areas were closed to small-tract filings. The number of unclosed cases as of June 30, 1957, was 51,700, as compared with 54,000 outstanding a year ago; a reduction of 4 percent.

Classification and Investigation

Land classification is the method by which the Bureau of Land Management seeks to attain its primary objective, which is to dispose of or develop vacant public lands for their highest use. In the continental United States, classification action under section 7 of the Taylor Grazing Act or under other statutory authority is essential before disposal of public lands may be allowed under the public land laws. In Alaska, authority to classify lands is limited to certain specific uses.

Application under the Small Tract Act was by far the most popular method used by the public seeking to acquire land for home, business, or recreation sites. Almost 115,000 acres were classified for small tracts during the year as against a total of 24,132 acres in fiscal year 1956.

Since World War II, the rate of population growth has increased rapidly in the Western States, particularly in California, Nevada, and Arizona. Although this population growth has been concentrated primarily in urban areas, large tracts, some over 100 miles from major population centers, have assumed "suburban" aspects. Many factors have contributed to this situation. The Bureau has been making every effort to accommodate this demand, while at the same time insuring the proper classification and disposition of the lands, including proper tract layout and establishment of development standards where appropriate.

To facilitate the resolution of conflicts due to competing applications for lands, reduce the backlog of cases pending action, and promote the controlled use and disposition of public lands, a special program was placed in effect in southern California on March 14, 1957, with the approval of the Assistant Secretary of the Interior for Public Land Management. These procedures involved no special regulations. Under the program, preference was given to small tract disposition over competing prior filed applications for the same land under other public land laws, except for competing State exchanges and prior filed State selections. Emphasis was placed on sales without prior leasing, rather than leases with option to purchase, in areas where the county governments had provided adequate zoning and development standards. The closure of San Bernardino County, Calif., to filing of individual small tract applications on unclassified lands was a key part of the program.

In the State of Washington, approximately 150,000 acres have been classified as suitable for State lieu selections. For other lands that cannot be effectively managed by the Federal Government, regularly scheduled public sales of isolated tracts have been instituted.

Development of a Manual on a standardized land appraisal system has been a major goal of the Bureau's land classification program. Procedures have been established to implement recommendations of the Departmental Committee on Land Appraisal. Reviewing appraiser positions have been authorized for the area offices. Appraisal review boards have been established in the area, State and headquarters offices, and a roster of Bureau of Land Management appraisal personnel has been prepared. Key personnel attended appraisal short courses at educational institutions. The Bureau's Area 3 conducted an appraisal training course for all field examiners, and retained a private appraisal consultant to direct the instruction. Instructional material in the form of Manual releases has been issued.

Withdrawals and Restorations

Withdrawals of public lands in the United States and Alaska during the year aggregate 291,810 acres. Lands restored from withdrawals totaled 1,736,595 acres, or about six times the total area withdrawn.

The excess of lands restored over that withdrawn resulted in part from (1) the continuing request of Congress that action on all pending withdrawal applications by the Department of Defense for areas exceeding 5,000 acres be suspended, and (2) implementation of procedures for stringent and critical review of justifications for the withdrawal of lands for any purposes in the United States or Alaska.

Significant improvements in the processing of land withdrawals and restorations included (1) initiation of a field procedure for systematic review of all present withdrawals or reservation, (2) preparation of new regulations which will standardize application and processing of withdrawal requests, and (3) provision for an inventory of nondecentralized withdrawal applications and restoration requests pending in Washington or in field offices of the Bureau.

MINERALS

The Bureau of Land Management is charged with administering the various mineral leasing laws and United States mining laws which are designed to encourage the exploration and development of the necessary mineral resources to sustain the expanding national economy and contribute to the national defense.

The Bureau's mineral program is accomplished through (1) leasing of minerals on public domain lands, privately owned lands in which the mineral rights are reserved to the United States, and certain acquired lands; (2) the issuance of mineral patents and other instruments relating to mineral resource development; and (3) studies relative to mineral and other resource development and use.

General

In keeping with the established policy of multiple use and wise use without abuse, constant effort was directed toward expediting development of public domain mineral resources by opening new areas to mineral development and administering other areas in a manner that encourages development.

The Bureau is directly responsible for the administration and disposal of mineral resources under the mineral leasing laws and United States mining laws on the 468 million acres of mostly unreserved public land—about 178 million acres in the United States and 290 million acres in Alaska. It also has a participating responsibility in the management and disposal of mineral resources in another 242 million acres of federally owned land reserved for various purposes, such as national forests, irrigation projects, power sites, military and atomic energy use and other public purposes.

Accomplishments

The volume of mineral activities on all of the above-mentioned types of lands continued at a high level throughout fiscal year 1957 except for the Outer Continental Shelf. No new OCS competitive lease sales were made during the year.

The Bureau's total earnings from royalties, rentals (including OCS), and bonuses from competitive oil and gas and other mineral leasing reached an all-time high of $83,396,659 as compared to $71,302,743 in fiscal year 1956.

These earnings were achieved through a program of wise multiple use designed to meet the ever-increasing need for our natural resources through intelligent, long-range management that will insure the protection and conservation of all our resources.

Regulations, Procedures, and Orders

During the past fiscal year numerous regulations and procedures were amended or written to expand the Bureau's program of opening new areas to mining and leasing.

Coal and phosphate regulations were amended to allow acceptance of relinquishments of leases, upon a satisfactory showing that the public interest will not be impaired, even though the lessee is subject to a remaining liability under the lease. Formerly thousands of acres of lands involved in lengthy litigation were tied up indefinitely.

An amendment to the Code of Federal Regulations (issued as Circular 1977) removed the 60-day waiting period formerly required for noting partial relinquishments on noncompetitive oil and gas leases on tract and plat books, thus making the lands available for further leasing as soon as they are noted on the tract and plat books.

Asphalt deposits in approximately 400,000 acres of former Choctaw and Chickasaw lands in Oklahoma are now available for leasing under new regulations issued January 12 (Circular 1968). These lands were acquired by the United States from the Choctaw-Chickasaw Nation of Indians by the act of May 24, 1949 (63 Stat. 76–84).

Lands in military reservations, reservoir areas, and other Government lands, not subject to mining location under the United States mining laws, are now available for uranium prospecting by permit, and mining under a Government lease. BLM will receive and process applications and the Atomic Energy Commission will approve and issue permits and leases.

An agreement has been reached with the Federal Farm Mortgage Corporation on procedures for leasing lands transferred to the Bureau of Land Management by Public Law 760. Some 6,500 tracts of land scattered throughout the United States have been transferred to the Department and some 12,000 other tracts will be transferred on September 6. Upon completion of a study of title records, regulations and procedures will be issued providing for the leasing of these lands.

Public Land Order 1400 issued March 29, 1957, opened 4,160 acres of land to potassium leasing. Approximately 1,840 acres of this land is scheduled to be leased on July 31.

Approximately 581,564 acres of land in Petroleum Reserve No. 7 of July 2, 1910, were opened to general mining location by Public Land Order No. 1403, dated April 2, 1957. Lands within this reserve had been open to leasing and to metalliferous mineral location, but prior to the issuance of Public Land Order No. 1403, they were closed to general mining location.

These substantial public land areas now opened to leasing exemplify the Department's and the Bureau's efforts to assure maximum beneficial returns from public lands through multiple use under effective conservation safeguards.

A new oil and gas acreage control system is being installed in the field offices to aid in administering the acreage limitation provision of the mineral leasing law.

Legislation

Final regulations under Public Law 167, the Multiple Use Act, were issued as Circular 1961 on September 28. This law provides the Government with authority to manage the surface resources on unpatented mining claims subject to the act and also removed "common varieties" of minerals from under the mining laws and placed them under the Materials Act.

Approximately 1,000,000 acres have been examined to date and publications ordered on about 900,000 acres. In addition, publication has been ordered on 10 million acres of Forest Service lands. Current operations indicate that "unlocking" of vast timber resources will benefit both industry and the Nation as a whole.

Under the administration of Public Law 357, which provides for the entry and location on discovery of a valuable source material on public lands classified or known to be valuable for coal, 2,913 claims were recorded as of June 1, 1957. This law permits a greater utilization of our natural resources in North and South Dakota and adjacent areas. Further progress in this area requires the development of an economical method of extracting uranium from coal. This problem is currently receiving the diligent attention and efforts of both Government and industry scientists.

Since the passage of the Multiple Use Mining Law in 1955 (Public Law 585), there has been a large increase in mining activities, particularly in uranium. This law also opened areas to oil and gas leasing that had formerly been covered exclusively by mining claims, and, conversely, opened some 60 million acres to mining location that had been previously closed due to the existence of oil and gas leases.

The administration of Public Law 359, which opened over 7 million acres of withdrawn power site lands to mineral development, has resulted in 8,116 filings covering approximately 169,276 acres.

Adjudication of Mineral Cases

On June 30, 1957, there were outstanding approximately 108,018 oil and gas leases on public domain covering 80,254,466 acres, including the Outer Continental Shelf. There were also 4,499 outstanding oil and gas leases on acquired lands of the United States covering 3,937,189 acres. A total of 2,350 permits, leases, and licenses for other minerals covering 3,435,320 acres were likewise in effect on public domain and acquired lands.

During fiscal year 1957, new and reactivated noncompetitive oil and gas lease offers and applications for lease totaled 62,121 and a total of 60,646 were closed during that period. Approximately 25,687 oil and gas lease assignments were handled during the period. During that same period the new and reactivated mineral patent applications amounted to 194 and 316 cases were closed during the year. In addition, there were 3,928 miscellaneous applications in connection with mineral locations and 5,483 of such cases were closed. In all, 92,132 cases were closed as against 90,509 received, reducing the backlog of cases pending from 24,387 to 22,764.

Table No. 1 shows the number of mineral cases adjudicated in the continental United States and Alaska during fiscal year 1957.

The chief source of revenue to the United States from the use and disposal of resources in the public lands is from leases issued under the mineral leasing acts. The revenues for fiscal year 1957 resulting from royalties, rentals, and filing fees under the mineral leasing acts, was $81,901,988 compared to $69,890,971 in fiscal year 1956. In addition to this, a major source of receipts is also derived from bonuses offered for the issuance of oil and gas leases. A summary of bonuses received from such competitive mineral leasing by States is shown in Table No. 2.

TABLE 1.—*Adjudication of minerals cases, Bureau of Land Management, fiscal year 1957*

Type of case	Cases pending July 1, 1956	New and reopened cases	Cases closed	Cases pending July 1, 1957
Public domain lands:				
Oil and gas leases:				
Noncompetitive	10, 962	59, 593	57, 727	12, 828
Competitive	1, 133	257	1, 316	74
Mineral leases	318	324	403	239
Mineral permits	1, 514	1, 456	1, 383	1, 587
Mineral patent applications	654	194	316	532
Other mineral locations	20	239	209	50
Acquired lands:				
Oil and gas leases:				
Noncompetitive	2, 635	2, 728	2, 919	2, 444
Competitive	----------	2	2	----------
Mineral leases	678	77	518	237
Mineral permits	1, 391	593	871	1, 113
Public domain and acquired lands:				
Oil and gas assignments	5, 017	24, 266	25, 687	3, 596
Resource sales	26	75	68	33
Outer Continental Shelf leases	39	705	713	31
Total	24, 387	90, 509	92, 132	22, 764

TABLE 2.—*Areas leased and bonuses received, competitive mineral leases, Bureau of Land Management, fiscal year 1957*

Type of mineral and State	Public domain lands		Acquired lands		Total	
	Acres leased	Bonus received	Acres leased	Bonus received	Acres leased	Bonus received
Oil and gas:						
Colorado	2, 557	$20, 315	----------	----------	2, 557	$20, 315
Montana	15, 893	110, 564	----------	----------	15, 893	110, 564
New Mexico	2, 441	243, 680	----------	----------	2, 441	243, 680
North Dakota	80	301	----------	----------	80	301
Ohio	----------	----------	68	$2, 658	68	2, 658
Oregon	124, 295	55, 691	26, 490	9, 671	150, 785	65, 362
Utah	80	200	----------	----------	80	200
Texas	----------	----------	538	278, 755	538	278, 755
Wyoming	9, 791	475, 570	----------	----------	9, 791	475, 570
Total oil and gas	155, 137	906, 321	27, 096	291, 084	182, 233	1, 197, 405
Coal:						
Colorado	----------	280	----------	----------	----------	280
Illinois	----------	----------	130	233	130	233
Montana	960	960	----------	----------	960	960
North Dakota	40	40	----------	----------	40	40
Utah	2, 383	2, 384	----------	----------	2, 383	2, 384
Wyoming	480	2, 400	----------	----------	480	2, 400
Total coal	3, 863	6, 064	130	233	3, 993	6, 297
Other minerals:						
Phosphate:						
Idaho	4, 368	285, 398	----------	----------	4, 368	285, 398
Wyoming	640	160	----------	----------	640	160
Sodium:						
Wyoming	5, 132	5, 390	----------	----------	5, 132	5, 390
Sand stone:						
Missouri	----------	----------	10	10	10	10
Uranium:						
Arizona	520	10	----------	----------	520	10
Total other minerals	10, 660	290, 958	10	10	10, 670	290, 968
Grand total	169, 660	1, 203, 343	27, 236	291. 327	196, 896	1, 494, 670

RANGE MANAGEMENT

Severe drouth conditions throughout many of the western range areas dominated the progress of range management programs during the past fiscal year. In the Southwest, continuous drouth since 1950 has left ranges and the range livestock industry in a critical state. The situation attracted national attention and resulted in a tour of the affected areas by the President and the Secretaries of Agriculture and Interior. The economic impact of the drouth on range livestock operators was reflected in requests for general waiver of grazing fees, and in many individual requests for remission of fees. Subsequently, the Secretary upon the recommendation of the Bureau postponed the changeover to a sliding scale grazing fee formula for 1 year, until January 1958. If the new formula had been affected, grazing fees would have advanced approximately 2 cents per animal unit month.

Although the drouth was general, local areas in northern Nevada, southern Idaho, and southeastern Oregon were favored with above average moisture in 1956. Abundant rainfall continued in these areas into 1957, and late winter snows in the Great Plains region, plus general spring rains, produced one of the best range forage crops in 20 years.

In Wyoming, Colorado, Utah, southern Nevada and Arizona, improved moisture conditions lessened the local effects of the drouth. Large areas of public rangeland in California and New Mexico were still plagued with drouth at the close of the fiscal year.

Early in the year range personnel were devoting considerable effort to relieving disastrous drouth conditions. Later in the year the lush forage growth, which had not been used, resulted in a high fire hazard and considerable effort was directed at suppressing range fires. In spite of these unscheduled events, good progress was made toward the accomplishment of planned objectives for the year.

Grazing Administration

A small increase in the grazing administration staff to provide for mineral activity under Public Law 167 relieved regular range personnel of this work, permitting more effort to be devoted to grazing functions. Continued emphasis on early completion of the adjudication of grazing privileges and related activities in gathering and analyzing basic data has resulted.

Analysis of the areas of responsibility of field offices led to the establishment of a new district office at Casper, Wyo., during the year. This office is unique in that it marks the first time that an area con-

Figure 25.—The Bureau of Land Management practices "multiple use" where opportunities for range and forest utilization, watershed protection, soil and moisture conservation, mining and mineral operations, and wildlife and recreation needs exist in the same area of public land.

sisting entirely of grazing lands administered under section 15 of the Taylor Grazing Act has been set aside for administration by a separate field office. It was necessary in this case to provide better supervision and control of the range as well as the development of a conservation program for over 2 million acres of Federal grazing land.

Significant strides were made in the control of grazing trespass on the public lands, which still continues as a persistent and difficult range problem. Control procedures must be further improved before trespass can be brought to an irreducible minimum. Progress has been made in the development of guidelines for the assessment of trespass damage of adequate reliability to be admissible as evidence in court actions.

Progress in completing the adjudication of grazing privileges is closely geared to range forage inventory surveys. These surveys are basic to reliable determinations of range grazing capacity and an equitable apportionment of grazing privileges among qualified users. Bureau policy on range surveys provides for constant striving to improve survey methods in order to improve their acceptability by both the range users and the public. Positive steps have been taken to implement this policy by the Bureau in assuming leadership among the Federal agencies having similar range responsibilities, for conducting a joint study of survey methods looking to improved techniques and uniform standards.

In addition to giving added emphasis to range and soil resource inventory of western range lands, the Bureau has participated in a cooperative survey of Kodiak Island, Alaska, with the Alaska Experiment Station and Soil Conservation Service. This is consistent with the efforts of the Department to aid in development of the small scale livestock industry which now exists in the Territory.

Proceeding under a policy of adjudicating the most difficult problem areas first, several key areas were handled in 1957. The present backlog of 102 appeal cases pending before the hearing examiner is less than it was 1 year ago. During the 1957 fiscal year, 68 new appeals were filed, while the examiner processed 83 cases. Processing of appeals to the Director has been expedited by placing an adjudicator on the range staff.

Wildlife Management and Recreation

Along with grazing by domestic livestock, wildlife and recreation are the most extensive uses made of the public grazing lands. Increasing big game populations are intensifying some local management problems. Bureau field offices are participating in an increasing number of wildlife studies in which the utilization of range forage by wildlife and livestock is being determined. These will provide basic information for herd adjustments and improved management practices.

Cooperation with State game departments on water development and reseeding projects is increasing, benefiting both wildlife and domestic livestock. The Bureau is participating in a proposed inventory of browse revegetation work, past and future, which will culminate in a general report of all agency activities in this field. The objective of this joint effort is to improve the range for wildlife and livestock.

Camping, hiking, and other forms of recreation have been increasing from year to year. The largest recreational use is associated with hunting of big game, and upland game birds and fishing. The total use can only be estimated by the annual kills of big game, usually estimated by the State fish and game departments. Wildlife management will always be a major factor in administration of public lands in the Territory of Alaska. The problem dealing with grazing of bear and livestock on Kodiak Island has resulted in certain amendments to the boundaries of the Kodiak National Wildlife refuge being proposed to the Department by the United States Fish and Wildlife Service and the Bureau. In addition, an agreement for management of reindeer in Alaska has been developed with the United States Fish and Wildlife Service and the Bureau of Indian Affairs and approved by the Department.

Range Studies

The gradual expansion of range condition and trend studies, which received new emphasis 3 years ago, has now attained an important status in the management of public rangeland. Additional range study transects to be used as a yardstick in measuring long-time changes in the condition of the range, are being established with each passing year. Semi-intensive methods for determining range condition have now been employed to cover a major portion of the range area. The cumulative effects of several years drouth has added to the significance of condition and trend studies. Reports for calendar year 1956 show a slight increase in the number of acres classified as "on a downward trend" due, no doubt, to the effects of drouth.

About 75 percent of the total range area is now classified in fair-to-excellent condition. The Bureau's program of condition and trend studies has been augmented by those conducted in cooperation with other agencies such as State fish and game departments.

Range utilization checks, largely abandoned during World War II, have been reactivated. A significant portion of every grazing district is being covered each year. These checks go hand in hand with the condition and trend studies and give an annual measure of the quantity of forage used by livestock.

Studies conducted in cooperation with western land grant colleges and Federal research agencies are in progress on several range management problems. Of most importance are those concerned with controlled pasture use from which actual use data will be obtained for application to the Federal range.

The Bureau's research program at the Squaw Butte Experiment Station in southeastern Oregon was transferred to the Agricultural Research Service of the United States Department of Agriculture. That agency is continuing the studies in cooperation with Oregon State College. This transfer was made in order to consolidate the work being carried on at the station with similar work being done by the Agricultural Research Service.

Change in Status of Public Grazing Lands

The Bureau has cooperated extensively with the United States Forest Service in working toward a transfer of certain land utilization project lands which are suitable for administration in conjunction with grazing districts, from the Forest Service to the Bureau of Land Management.

Numerous contacts with local groups and agencies were made, and three public hearings were held in Montana to obtain a full expression of the desire of local residents on the matter. Final action on the transfer is now pending.

Soil and Moisture Conservation

The second year of the Department's 20-year program for conservation treatment of Interior lands has produced very beneficial results. Recent watershed planning has been directed toward acquiring better coordination between conservation activities and grazing management. To adequately safeguard conservation projects it is necessary that proper grazing use of range vegetation be established. Definite efforts have been made recently to complete essential management adjustments prior to the installation of conservation practices.

Prominent among projects placed on the range are reseeding, retention and detention dams, contour furrowing, protection fencing, and water developments. In particular, emphasis has been given to the latter two in connection with management programs in order to acquire better control of grazing use. Along with many of the detention dams, waterspreading dikes are also installed that have proven very effective on some range areas by greatly increasing the vegetative cover.

Two additional practices that have recently become prominent are brush eradication and soil pitting. Thousands of acres of juniper have been eradicated, by means of chaining or dozing, particularly in the Southwest. The eradication of sagebrush has also been completed on many areas by means of railing, chaining, chemical spraying (usually by airplane), mulching with a brush cutter, or plowing. Several of these practices are frequently followed or accompanied by seeding the area to perennial grasses.

A series of research studies on erosion, runoff, and sedimentation are being conducted with various agencies in the Southwest and particularly in Arizona. The Geological Survey is collecting hydrological data to be used in watershed planning and the Agricultural Research Service in completing evaluation studies on the efficiency of detention dams in trapping silt. Water yield studies are being conducted on the San Simon Wash in Arizona by the Geological Survey to determine the effect of structural treatments on annual runoff to the Gila River.

Range Improvement

The range improvement fund has been largely devoted to the maintenance of existing range improvement. Part of it has also been used for construction of new facilities, such as livestock water developments and allotment boundary fences. Livestock watering reservoirs, spring developments, and wells are constructed not only for the benefit of livestock, but also for obtaining better distribution of livestock on the range and elimination of unnecessary movement of livestock for great distances between watering places. Fencing of ranges is needed for livestock control in order to assure more even utilization and the proper season and intensity of use of forage plants. In this effort substantial contribution from range users is received for maintenance of projects. Grazing permittees are required to maintain a majority of improvements placed upon their use areas. Many range improvements are constructed entirely with the funds and facilities of range users. These are authorized under provisions of sections 4 and 15 of the Taylor Grazing Act. The use of section 4 permits varies in different States and districts, depending upon local conditions.

Weed Control

For the past 6 years the Bureau has operated a program for the control of halogeton, a poisonous range weed. Although concerted efforts have been made to control halogeton; it continues to spread and infect additional range areas each year. An estimated 11.5 million acres are now affected, of which 8.4 million acres are administered by BLM and the remaining 3.1 million acres are private, State, or other Federal lands. Each year the Bureau makes surveys of large areas to locate any newly infected areas. During fiscal year 1957, approximately 10 million acres in the Western States were surveyed.

Considerable progress has been made in reducing the livestock poisoning effects of this plant. While a great many sheep are still poisoned each year in the more heavily infected areas, these losses have not been widespread. Livestockmen have become acquainted with the plant and with effective methods of handling livestock to avoid losses. The control program of the Bureau has significantly influenced the effect of this plant on livestock using the range, as well as on the range itself.

The main direct attempt to control halogeton has been chemical spraying. During the past year nearly 28,000 acres of land have been sprayed with a low volatile ester of 2,4–D. This chemical treatment has been effective in reducing the rate of spread of the plant by preventing seed development. Generally the former program of spraying large extensive areas has been replaced with operations covering only scattered spots and the edges of general infestations usually along rights-of-way and other avenues of spread. Good cooperation has been received by the Bureau in the halogeton control program. Range users have made contributions in cash, materials, or labor. The Bureau of Reclamation has reimbursed BLM for treating certain areas under its jurisdiction. Likewise, State departments of agriculture, railroad companies, weed control districts, and other agencies and organizations have been helpful on many areas in control operations. The Bureau has cooperated with research organizations to increase the fund of knowledge concerning the nature and habits of halogeton and effective means of control. The Bureau has entered into research agreements with the Agricultural Research Service and

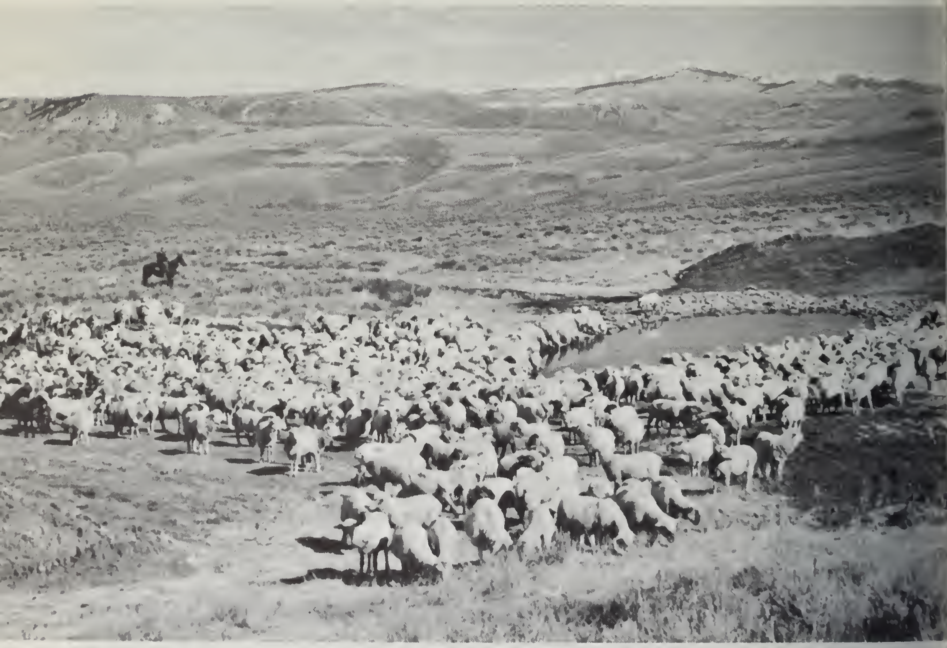


FIGURE 26.—The development of water on arid ranges is an important part of the range improvement program conducted by the Bureau of Land Management, under authority of the Taylor Grazing Act. This structure, in Colorado, is typical of those which make possible most advantageous seasonal use of the Federal range.

the Agricultural Experiment Stations of the States of Idaho, Nevada, Utah, and Wyoming. Under this cooperative endeavor many findings important in managing halogeton infested ranges have been made.

FORESTRY

The Bureau of Land Management has exclusive jurisdiction over approximately 161 million acres of forest lands in the United States and Alaska. These lands are protected from fire, insects, disease, and other hazards; they are managed for compatible multiple uses under the principle of sustained yield and improved through rehabilitation and reforestation of nonproductive areas.

During the past fiscal year concentrated efforts were made to develop a better balanced program through expansion of inventory, rehabilitation and reforestation, timber trespass, program planning, recreation, improved administrative procedures, and closer coordination with other Federal agencies and related activities. Enthusiastic cooperation and assistance of Bureau personnel, industry, local communities, and other public agencies have contributed to the substantial progress made in each of these activities.

Nature and Scope of BLM Forestry

The 161 million acres of forest land administered by the Bureau of Land Management includes more than 2 million acres of the so-called O. and C. lands contained in an 18,000-square-mile checkerboard in western Oregon, 34 million acres of public domain lands scattered throughout the Western States (plus some limited acreages in certain of the Eastern States), and an estimated 125 million acres of public domain in Alaska. Of this amount approximately 6,125,000 acres in the United States and about 40 million acres in Alaska are classified as "commercial" forest lands; lands which support timber of a size, quality, and quantity suitable for economic production of sawtimber under currently prevailing conditions. The remaining 30 million acres in the United States and 85 million acres in Alaska support timber suitable for production of mine props, ties, posts, fuel wood, and limited sawtimber and are classified as "woodlands." As other available supplies of timber decline and as technological and economic conditions change it is likely that much of the "woodlands" may be reclassified as "commercial" forest lands.

The aggregate volume of BLM "commercial" forest lands is estimated to be 260 billion board feet. The estimated volume on the woodlands totals 212.5 billion board-feet. The current annual productive capacity of all BLM forest lands is conservatively estimate as 3.4 billon board-feet. The timber and related resources on th Bureau's vast timberlands represent one of the Nation's most valuable natural resources. They are one of the assurances of the continued well being of the Nation and its people.

The nature of BLM forest lands, their location and the diversit of their products and uses are such that different types of fores management programs must be devised. Programs now in effec may be considered to be of three major types:

1. Intensive sustained yield management for the production o sawtimber and for the other purposes, as illustrated by the O. and C lands of western Oregon.

2. Similar but less intensive sustained yield management takin into account disposals under applicable public land laws and thos circumstances peculiar to the timber, lands and uses involved. Th program for the public domain forest lands in the United States i representative of this type.

3. Extensive forest management dominated by very acute fire protection problems and involving vast, undeveloped areas. The program for the public domain forest lands in Alaska is an example of this type.

Comprehensive, detailed forest management programs and plans are essential for orderly, businesslike administration of BLM forestry activities. During fiscal year 1957 major revisions were made in BLM forestry (and other functional activities) programing techniques. The resulting material provides a means not heretofore available, for developing balanced, integrated, multiple resource programs for BLM forest lands. Such programs show estimated total jobs, by major activity, to be done and that portion of the total job to be carried out during the current and next 2 succeeding years, along with estimated requirements to do these jobs in terms of manpower, materiel and money. These data also provide a useful base to evaluate the effectiveness of current and previous expenditures of manpower, materiel and money.

Detailed "forest management atlases" were put into wide use throughout the O. and C. area during the past fiscal year. These "atlases" provide a means for maintaining a detailed, up-to-date status of current and proposed forestry activities for given geographic units. They have already proven to be a useful tool for more efficient management of the O. and C. and CBWR grant lands. Other public and private forest management agencies have requested that copies of this material be made available for their own use.

Forest Inventory

Accurate, up-to-date inventory of the forest resource is a prerequisite of a sound forest management program.

Continued progress was made on inventory of timber on the O. and C. and CBWR grant lands in western Oregon. This very intensive inventory is expected to be completed during 1960. As a result of new inventory data the annual allowable cut for these lands was increased on October 26, 1956, by 46.6 million board-feet to a total of 660.7 million board-feet. Inventory now in progress is expected to raise these cuts still higher.

During the past fiscal year new techniques were developed to provide even better inventory data. This technique involves use of permanent sample-plots and compilation of data on tabulating machine cards. This procedure, recently placed into practice, will provide greater efficiency, economy and accuracy in the continuous timber inventory process.

Comprehensive plans for detailed inventory of public domain forest lands in the Western States were developed during the past fiscal year, and extensive areas were inventoried in California, Oregon, Idaho, Utah, Nevada, Arizona, Montana, Colorado and New Mexico. An extensive inventory, through use of chartered aircraft, was completed for public domain forest lands in Wyoming.

A comprehensive plan for inventory of the forest resources in Alaska, including special techniques and procedures, was developed jointly with the Forest Service. Active inventory projects, based on these plans and techniques are now being carried out in Alaska.

A forest inventory Manual release which outlined policies and broad guidelines was prepared and issued to field offices to assist these offices in developing uniform, standard inventory practices.

Access to BLM Forest Lands

The scattered nature of much of BLM forest lands, heavy demands for forest products and related resources make access to BLM timber one of the most acute management problems. Progress of the past fiscal year has probably been the most significant and far reaching of any single previous year. Prominent items include a comprehensive 6-year plan for access roads on the O. and C. lands, a Manual release for the O. and C. right-of-way regulations, roads records system, policies for coordinating road construction between public agencies and other matters.

The 6-year road plan includes a program with estimated construction costs totaling $68.5 million for approximately 800 miles of mainline access roads.

Plans were developed and appropriations were obtained for the first time for acquisition of rights-of-way and roads necessary for public domain timber sales in Oregon and Colorado. This will provide a long needed "tool" for the rapidly expanding public domain timber sales program.

A Manual release covering O. and C. right-of-way regulations was prepared and issued to field offices. In the brief period during which it has been in effect this manual has greatly simplified many aspects of the O. and C. right-of-way processing.

A detailed road records system for O. and C. timber access roads was developed and placed into effect. The technique outlined therein will permit expeditious uniform processing of road use charges and road amortizations not heretofore possible.

To date, $22,350,000 have been appropriated for construction or acquisition of O. and C. access roads and 165 miles of mainline access roads and 15 bridges have been built or are now under construction.

Timber Sales

The various activities which make up the timber sales process continued to absorb a major portion of BLM forestry efforts. During fiscal year 1957, 781 million board-feet of timber valued at $21,264,021.58 were sold from Bureau forest lands. Receipts to the United States Treasury from BLM forestry activities during this past fiscal year totaled $21,471,604.26.

Timber from the O. and C. and CBWR grant lands accounted for 628,682,000 board-feet of this amount. Public domain and other types of timber sales made up the remainder.

A comprehensive review and analysis of existing regulations applicable to the sale of BLM timber was completed during fiscal year 1957.

New and improved regulations and contract forms for the sale of O. and C. and CBWR timber were developed during the past fiscal year. A Manual release, supplementing these regulations, has been drafted and will be issued shortly after the regulations are made effective.

A revised and improved technique for cruising and appraising western pines was developed and placed into effect.

On April 1, 1957, after public hearings and evaluation of all pertinent data, marketing restrictions for timber cut from O. and C. and Coos Bay Wagon Road grant lands were revoked. The marketing restrictions, imposed following public hearings in 1946 and 1947, provided that timber cut from O. and C. or CBWR grant lands must receive primary processing within the marketing area in which it was harvested. Technological advances, changes in the lumber industry, and in local and national economies had made these restrictions obsolete. More complete and more profitable utilization of BLM timber can be expected as a result of revoking the marketing restrictions.

A recent policy statement providing for coordinating the O. and C. annual timber sale plan with annual sale plans of nearby national forests should prove most helpful to the timber industry, other public agencies, and the public.

Rehabilitation and Reforestation

Another prerequisite for sustained yield forest management is adequate provisions for regeneration of commercial species on cut-over, burned, or otherwise denuded lands.

Continuing demands for forest products, dwindling supplies of readily available timber, high stumpage prices and very productive lands make it good business for the BLM to program for rapid reforestation of denuded lands. During the past fiscal year 3,809 acres of cutover O. and C. lands were planted with nursery-grown trees. Since 1951, 23,820 acres of O. and C. lands have been planted with such trees. An additional 827 acres were seeded during fiscal year 1957. This amount, together with areas previously seeded, totals more than 9,575 acres. The areas reforested by seeding or planting since 1951 total 33,398 acres.

During the past fiscal year detailed plans were made for increasing the area of O. and C. lands reforested annually by planting or seeding approximately 35,000 acres. This greatly expanded program will be placed into effect in fiscal year 1958.

A continuing, large-scale reforestation program will assure future supplies of forest products and, through reducing the period usually required for restoring forest lands to full production, increase the average annual yield of timber on the O. and C. lands.

Timber Trespass

Unauthorized cutting and removal of timber from BLM forest lands has been a growing menace to the Bureau's forest management program. This exceedingly complex problem is further complicated by the many different State civil and criminal statutes which are applicable to timber trespass. Some States have no applicable statutes, civil or criminal, under which a timber trespasser may be prosecuted. In such States, effective control of timber trespass on BLM forest lands is even more difficult than in the States which have applicable but inadequate statutes.

During the past fiscal year BLM forestry personnel in California, with the assistance of Federal law enforcement agencies and local courts, have succeeded in obtaining a conviction under criminal statutes, of a party who knowingly cut and removed timber from BLM forest land. This is the first such conviction in the judicial history of that State. A significant and far-reaching precedent has been established as a direct result of actions undertaken by BLM forest personnel. It is likely that this conviction, more than any other single factor, will probably pave the way for eventual control of trespass on BLM forest lands and thereby materially reduce annual losses estimated at $1 million as a result of such trespass. Another direct result of this conviction is the recent enactment of a timber trespass statute by the State Legislature of California. This statute will provide another long-needed tool for control of timber trespass on BLM forest lands in that State.

Recreational Use of BLM Forest Lands

The outstanding esthetic and recreational potential of many of the O. and C. and CBWR grant lands and much of the public domain in Alaska have been recognized for many years. During fiscal year 1957, through the combined efforts of BLM and National Park Service personnel, a comprehensive survey of the needs for development of this vast recreational potential was undertaken. The survey included field examination of possible sites, development of standards, specifications and estimated costs for equipment and facilities for camp grounds, picnic areas and other recreation areas, and recommended program projects. It is expected that initial action on the higher priority projects will be undertaken during fiscal year 1958. A number of recreational sites of various types were developed pursuant to Public Law 507 during the past fiscal year on BLM forest lands in Alaska. It is expected that these sites will help to reduce the number of man caused fires in addition to serving other purposes.

The public enjoyment and benefits from use of these recreational areas, while difficult to measure in monetary terms, are nevertheless substantial.

Organization and Administration

During the past fiscal year comprehensive, detailed organizational surveys were made of a number of BLM forestry field offices, including those in the O. and C. area in California and Alaska. As a result of these surveys more decentralization of BLM Forestry activities is being undertaken through establishing additional field offices in some areas and by realignment of staff duties and responsibilities in others.

Numerous other recommendations to improve efficiency and service have been or are being placed into effect as a result of these surveys.

Fire Protection

Adequate protection of the timber and related resources on BLM forest lands from fire, insects, diseases, and other hazards is another prerequisite to good conservation and a sound resource management program.

In Alaska the Bureau maintains its own fire detection, prevention and control organization. Valuable assistance and cooperation are provided by the Territorial, military and private agencies, and individuals. In the United States the major portion of fire protection efforts are through contracts with the Forest Service, State and private fire protection agencies.

During fiscal year 1957 continued progress was made in establishing radio communication facilities in various field offices in the Western States. Plans were prepared for installation of new radio communications systems in Alaska. Modest additions were made to existing supplies of tools and fire suppression equipment in many of the field stations.

An interim fire danger rating index, developed with the cooperation and assistance of the Fire Research Division of the Forest Service, was placed into effect in Alaska. This index will enable BLM personnel to better evaluate the various hazards which might promote uncontrolled forest fires.

Extensive use was made of aircraft for patrol during periods of high fire danger in Alaska and certain Western States.

Plans were made for the inauguration of "smokejumping" in Alaska. This technique will be adopted when adequate facilities have been constructed. "Smokejumping" will enable BLM fire fighters to get to fires before they become uncontrollable. The vast majority of fires in Alaska are not accessible by road and an effective air arm is an essential item in the control of forest fires.

Helicopters and charter aircraft were used extensively to ferry fire fighters and material to and from fires in Alaska. The helicopters proved to be particularly effective in otherwise inaccessible areas.

Contract protection for about 6.5 million acreas of BLM forest lands in the United States was continued.

During the past fiscal year a Manual release covering policies and guidelines for determining the amount of damages to timber and related resources as a result of fires was prepared.

Efforts to control insect infestations in BLM forest lands were expanded during fiscal year 1957. A limited area in north central California was treated to control pine bark beetles, and approximately 87,560 acres in Montana were treated to control a spruce budworm infestation discovered in 1956.

Disease control measures were directed against white pine blister rust on a limited area of BLM forest lands in southern Oregon.

Training

The Bureau of Land Management currently employs a permanent staff of about 310 professional foresters, and approximately 100 nonprofessional or seasonal personnel (including clerical and stenographic), to carry out its many forestry activities. Because of the complex and highly diversified nature of the Bureau's forestry program extensive on-the-job and other types of training are required.

During the past fiscal year numerous training sessions for forestry personnel were held by various offices or in cooperation with forestry schools or other public or private agencies. Such sessions included special group training in timber cruising and appraising, road location and construction, forest inventory, rehabilitation and reforestation, fire detection and suppression, program planning, timber sales and timber trespass. On-the-job training for these and other activities are carried out on a continuing basis. These "investments" in training pay off in better and more efficient performance throughout the employees' service with the Bureau.

CADASTRAL SURVEYS

The Bureau of Land Management is the official Federal agency for conducting the public land surveys in the United States and Alaska. These surveys establish and identify the boundaries of the public lands and divide the lands into areas conforming to the rectangular survey system. Land boundaries must be known before a comprehensive land management program can be initiated, including the development and conservation of the natural resources. The survey work of the Bureau is limited by law to the survey of the public lands under its jurisdiction. Surveys conducted for other Federal agencies are done on a reimbursable basis. The law also permits private contributions to defray the cost of cadastral surveys on the public lands.

Most of the public lands in the continental United States are located in the 11 Western States. In those States there are more than 100 million acres of public lands over which the cadastral survey "net" has not yet been extended. In addition, over 50 million acres of public lands are in need of resurvey to restore lost or obliterated markers and to correct earlier surveys made before the development of modern precise survey equipment and methods.

The 1957 Program

The cadastral surveying program of the Bureau of Land Management for fiscal year 1957 was designed primarily to aid, to the fullest extent, in the management of lands and the development and conservation of the natural resources; to lay out homesites for the Nation's increasing population; and to mark out on the ground the boundaries of lands granted to the States for benefit of their schools.

Surveys in the forest areas in Oregon and California were made to define the boundaries between private and Federal lands for settlement of trespass and for the determination of the boundaries of sales units.

Of major importance, especially to some of the Western States, has been the survey of school sections. The sections must be surveyed before the States can secure title to them. The vast increase in the development of the resources existing on the public lands has created a demand by the States for the survey of their school sections. The determination and location by cadastral survey of the boundaries of Federal range lands is also an important part of the program.

The subdivision into units of five acres or less to meet the demand for homesites and the resurvey of areas for oil and gas leasing and exploration, where the original survey monuments have been obliterated, was another major part of the program. In Alaska, surveys were made primarily for homesites and settlement purposes and for oil and gas leasing.

Work has continued on the preparation of leasing maps on the Outer Continental Shelf. These maps provide descriptions and area of the off-shore lands being leased for oil and gas. Due to recent technological improvements in drilling operations the oil and gas leasing maps on the Outer Continental Shelf off the coast of Louisiana have been extended to include areas extending seaward from the coastline to the limits of the shelf—reaching depths of up to 600 feet.

Experiments have been made in the use of helicopters to transport survey crews and equipment to work areas in rough, remote, and mountainous areas in southern Utah where it is almost impossible to complete that work by ground methods. The results of these tests demonstrated a 20-percent reduction in the cost-per-mile of survey work, while at the same time the output of the crews was more than doubled. In the future, helicopters will be used as an aid in making cadastral surveys in rough mountainous areas. The Bureau is also studying the feasibility of using precise aerial photographic equipment and methods in survey work.

Surveys in Continental United States

Cadastral survey projects completed during fiscal year 1957 consisted of the survey and resurvey of 1,418,431 acres of public lands. The surveys included the identification of the sections granted to the States for the benefit of their schools; the survey and resurvey of mineral lands as an aid in the development of those resources, primarily oil and gas; the resurvey of forest areas to define the boundaries of timber management units for the settlement of trespass cases and to provide a basis for timber sales; the survey of grazing lands; and the survey of small tracts to provide home and business sites.

Other projects were carried on by the Bureau for other Federal agencies to facilitate their land management activities and the development and conservation of the natural resources. This type of work included extensive resurveys for the Bureau of Reclamation in the Missouri River Basin and on the Trinity River project in California; resurveys for the National Forest in California and Arizona; resurvey of Indian lands in New Mexico; resurveys in Colorado for the Bureau of Standards to define and mark the boundaries of their lands; and the resurvey for the Department of the Army of the boundaries of the Hunter-Liggett Military Reservation in California. The program also included other surveys and investigations, such as the survey of islands and omitted land areas. Numerous maps and diagrams were prepared for the Department of Justice in connection with pending litigation involving certain Indian claims.

The survey of school sections made 128,880 acres available to the States of Arizona, California, and Utah. Although there are large areas of unsurveyed lands remaining in all the Western States, the need for completing the original surveys in order that the States may obtain title to the school lands exists primarily in those three States. In general, the program was based on the desires of the States to cover the areas of greatest value and interest.

In the other Western States the unsurveyed areas are located principally in permanent reservations such as national forests, parks and monuments, and Indian reservations. In these areas, indemnity selections have been made by the States for a large portion of the designated unsurveyed school sections in the reservations and school lands in those States, to a large extent, have been satisfied.

Alaska Surveys

The field program for Alaska was designed to meet the needs for the management of the public lands; the development and conservation of the natural resources; and to accommodate the expanding economy of the Territory and its increasing population.

During the fiscal year several urgent Alaskan projects were undertaken. One accomplishment was the survey and resurvey of 35,840 acres of land under the rectangular system of surveys. In addition, survey was made on 1,172 small tracts; 2 homesteads; 36 homesites; 12 trade and manufacturing sites; 2 headquarters sites; 1 Alaska public sale tract; 4 recreational sites; 242 townlots in one townsite; and 7 miscellaneous surveys.

OUTER CONTINENTAL SHELF

The Outer Continental Shelf Office at New Orleans is administered by the Eastern States Office of the Bureau of Land Management. During 1957, the office acted on an increasing number of applications for rights-of-way for pipelines and took several important actions resulting from the United States-Louisiana operating agreements of October 12, 1956. In addition, assignments, relinquishments, and other actions on approximately 500 oil and gas and sulphur leases were performed.

Two hundred and sixty-four leases were validated for the Louisiana State Mineral Board, and over 300 section 6 leases were extended.

Close contact was maintained with oil and gas lease sales by the Gulf States, and where areas to be leased by the States were in conflict with the OCS areas administered by Interior, appropriate notices of protests were directed to the States concerned.

There were no new OCS lease sales during the fiscal year due to the boundary dispute with Louisiana now before the Supreme Court, in which the other Gulf Coast States may join, and also because there were other uncertainties such as the large area in the Gulf requested by the Navy in which oil and gas and sulphur leasing and drilling would be restricted.

As of June 30, 1957, there were 495 OCS section 6 and 8 oil and gas leases and 5 sulphur leases covering 1,711,170 acres from which a total of $305,542,733 has been collected to date. Of this amount, $107,141,429, the total collections up to June 30, 1957, from the area in dispute, have been placed in escrow pending decision of the Supreme Court on the issue involved in *United States* v. *Louisiana*.

EASTERN STATES

The Eastern States Office in carrying out its 1957 program in the southern States of Alabama, Arkansas, Florida, Louisiana, and Mississippi, and in the Lake States of Michigan, Minnesota, and Wisconsin transferred title on 84,423 acres of public lands to non-Federal ownership largely by area and public sales to individuals. This comprised 800 tracts, including small tract auctions. In the above acreage was 18,000 acres of State selections and exchanges, 1,500 acres transferred to two States under the Recreation and Public Purposes Act, and 4,600 acres to qualified individuals under the Color of Title Act. Receipts from sales amounted to about $700,000, of which $300,000 was for 25¼ million board-feet of timber that went with the land.

The Russellville, Ark., office completed about two-thirds of its sales program in the southern States leaving approximately 44,000 acres of public lands in those States. This should be largely sold or otherwise transferred by early 1959, with the bulk of the remaining public lands in the States of Alabama, Louisiana, and Mississippi mostly under color of title or some other form of conflicting claim.

The Lake States program, with the fieldwork under the local office at Bemidji, Minn., has progressed to where disposals in Michigan and Wisconsin are nearly finished with only 7,000 acres remaining in these two States, and most of that now in pending exchanges with the Forest Service, United States Department of Agriculture, and the States concerned.

A management program including timber and large-scale Christmas tree sales now in progress in Minnesota which has approximately 100,000 acres of vacant public lands. About two-thirds of this is in tracts too large to sell or transfer under the public land laws, or is in withdrawals that should be retained for public purposes and recreational uses. Most of the smaller scattered tracts will be offered at public sale in the next year.

APPEALS

As the result of a comprehensive management study, a special unit was established in April 1955 in the Division of Technical Programs to more effectively and expeditiously handle cases on appeal to the Director of the Bureau of Land Management.

Formerly, cases had been processed by the various program staffs. Establishment of the Appeals Office has made possible the separation of appeals work from staff operations, thereby providing centralized and unified control on appeals actions. The processing of appeals work is now located in a single organizational unit which is responsible for such actions from the time the appeal is first received until formal disposition of the case.

Coincidental duties of the appeals staff include the maintenance of appropriate legal, reference, and statistical data and the distribution of such information throughout the Bureau.

When the Appeals Office was established in 1955, there was a backlog of nearly 1,200 lands and minerals cases on appeal. That backlog has been substantially reduced.

In the 2 years of its existence the Appeals Office has disposed of over 3,600 appeals cases through formal decisions. In addition a total of 3,368 miscellaneous memoranda and letters have been prepared during the 2-year period. The prompt and efficient handling of appeals actions and eventual elimination of the appeals backlog will substantially improve the Bureau's operations and its services to the public.

Two major management innovations have been initiated by the Appeals Office. In order to facilitate adjudication operations in the Bureau's field offices, all decisions prepared by the Appeals Office are duplicated for distribution to the field. In addition, the Appeals Office has prepared and issued a digest-index of appeals decisions that is made available to all adjudication personnel of the Bureau. As the result of the significant contributions which this office has made to the Bureau's public service function, the Appeals Office was awarded a unit citation for meritorious service covering the first 2 years of its operations.

INTERNATIONAL COOPERATION

Facilities and officials of the Bureau of Land Management were utilized as requested by the International Cooperation Administration and other specialized agencies on foreign programs within the fields of the Bureau's primary technical competence. All requests were met for technicians for overseas assignments, Bureau facilities and officials to assist foreign technicians working in the United States, technical backstopping of international activities, and technical advice and support of United States positions for international conferences.

The Bureau's long experience with fundamental resource development problems on the public domain is being carried to essentially every free world country. There is a constant exchange of ideas with technicians of other countries. Increasing activities in the large number of underdeveloped countries are emphasizing the necessity of improving basic land policies and practices to meet the needs of expanded resource development. These are the countries which have the extensive productive land areas and undeveloped resources for future land settlement and raw material requirements of the free world.

While the land and resources of the underdeveloped countries ordinarily have only started to reach their development potentials, results of land management activities particularly adaptable to these countries are encouraging.

STAFF SERVICES

The function of the Division of Staff Services is to provide necessary service in various fields to all of the functions and operations throughout the Bureau, both in Washington and in the field. The Division of Staff Services is under the supervision of the Associate Director. Three principal offices operate within this division to carry out the majority of the continuing functions charged to the Division of Staff Services. These three offices are: (1) the Office of Hearings Administration, (2) the Management Improvement Office, and (3) the Program Coordination Office.

Office of Hearings Administration

During the year, measures to facilitate the orderly and timely disposition of proceedings before the Bureau in which formal hearings are required, were carried forward. Such hearings provide the basis for adjudication of various types of claims, entries, and proceedings arising under Federal laws and departmental regulations, relating to the use and disposition of public lands and their resources.

On May 1, 1956, the Department rules of practice for the conduct at hearings were revised. As a major change and improvement, land office managers were relieved of the responsibility for performing hearing functions.

In October 1956, the Department's rules of practice were further revised to incorporate all provisions of the Administrative Procedure Act (5 U. S. C. 1001 et seq.) relating to adjudication based upon hearings, including the utilization of hearing examiners, qualified and appointed under regulations of the Civil Service Commission.

By the close of the year, eight hearing examiners, each with specialized experience in the Bureau's work, had been appointed and were actively engaged in hearing cases and rendering decisions on them. The examiners are headquartered at points within the 11 Western States where most of the cases requiring hearings arise.

A summary of the Bureau's hearings activity during the year appears in the following table. More than half of the fiscal year had elapsed before several of the hearings examiners had been appointed, and their offices placed in operation. This explains, in large measure, the slight increase in unclosed cases between the beginning and end of the fiscal year.

Total number of hearings, Bureau of Land Management, fiscal year 1957

	Number of hearings
Unclosed cases before hearings officers at beginning of year	228
Referred to hearings officers during the year	229
Heard during the year	149
Closed during the year	217
By decision following hearings	123
By action not involving a hearing	94
Unclosed cases before hearings officers at close of year	240

Office of Management Improvement

The Management Improvement Office administers management improvement, incentive awards, records management, forms management, docket control, organization and method studies, regulations and manual releases, and special management studies in the Bureau.

Washington and the four area offices scheduled and worked on a combined total of 103 management improvement projects during the year. These included both major, bureauwide projects and several of local scope. In addition, each of the State offices, and the districts within each State, conducted active programs on management improvement projects pertaining to operations under their respective jurisdiction. In 1957, Washington and area offices scheduled 43 management improvement projects considered to be of major importance. State, land and district offices are participating in this program with many projects pertaining to their local operations.

Increased workload in incentive awards activity during fiscal 1947 necessitated some decentralization of operations, by delegating certain award authority to each of the four area field offices.

Special management studies of major significance undertaken during 1957 included: a study of the Sacramento, Calif., forest district office; studies of the management of the O. and C. land, and of the five district offices established in Oregon to manage these lands; an organization and methods study of the Utah Land Office; and a comprehensive study of the reorganization plans for Bureau operations in Alaska.

Office of Program Coordination

The Program Coordination Office provides a system for the recordation of future program proposals by all activities of the Bureau, and an orderly method for communicating these proposals from the originating field office to the Washington Office for review, approval or revision. Horizontal coordination among various technical and administrative staff functions within any supervisory level of the organization is also fostered by this program. The program technique and system provides the primary source for the development of the Bureau's budget prior to submission to the President.

Greatest advances made in operation of this office during the fiscal year 1957 were in the program planning system. A program planning conference was held in Denver, Colo., at the beginning of the fiscal year (July 1956) for the purpose of obtaining the cooperation and viewpoints of personnel working at different levels in the various activities which the Bureau operates and to design a workable system and medium for uniform planning of future operations in each of these activities. The conference was composed of several committees which were each responsible for designing program planning systems and forms to be used. The committees collectively resolved a system which, when put into effect in the fall of 1956 for use in developing the 1959 program proved highly satisfactory.

A second conference, held at San Francisco, Calif., in April and May of 1957 to refine and revise the system designed in Denver was very successful. The results have been published and distributed to the field for use in preparing the proposed fiscal year 1960 program and its accompanying budget. Preliminary review and revision of a program progress reporting system to be initiated in the near future was also accomplished at this conference.

The system now in use, and the medium provided for program planning, provides for a uniform submission of program proposals.

The use of programs founded on the judgment of those directly responsible for their execution in developing a budget request, and the spending appropriations based upon these requests, helps to insure: (1) more realistic development of resources and lands under the jurisdiction of the Bureau; (2) more equitable treatment of "first problems first;" (3) better service to the public.

Records Improvement Project

The project received an initial allotment of $575,000 at the outset of the year, and subsequent allocations to bring the total to $682,000. These funds were expended on three major projects. Two of these were contracts, one for $242,500, and one for $229,500 for reconstruction of the Utah and New Mexico land records. The third project involved purchase of auxiliary equipment incident to the use of the new records system, such as insulated tabulating card filing cabinets and microfilm readers for distribution to the land offices. New map-filing cabinets, binders, and shelving units, especially designed for the new records, were procured for installation in the land offices at Salt Lake City and Santa Fe.

Plans for the fiscal year 1958 include advertising for bid to reconstruct the records of Oklahoma during the early part of the year, and, if funds permit, for another contract to reconstruct the records of another State.

STAFFING

The Bureau continued its emphasis on comprehensive training to provide for maximum utilization of employees skills. Approximately 80 formal training sessions have been conducted on a Bureau, area, and statewide basis. Special attention was given to the development of professional forestry and range personnel. Under an agreement with the Civil Service Commission, forestry and range personnel at the GS–5 and GS–7 grade levels are given intensive training over a 6-month period to furnish them with a variety of progressively responsible experience to accelerate their development. This intensive training not only furnished a definite means of better utilization of technical skills and improved development of career employees in shortage categories, but also provides greater incentive through increased opportunity for more rapid advancement. In addition to the formal training program for forestry and range personnel, a special training program was conducted for potential land office managers. Participants in the program were selected on the basis of their demonstrated ability in the field of management. Four management trainees, representing three of the four areas and the Washington office, participated in the Department's eighth management training program in Washington.

The current shortage of engineering, range and forestry personnel was met by an intensive recruitment program. Brochures describing the Bureau's work program were prepared and distributed to major colleges. In addition, Bureau personnel visited the colleges for the purpose of interviewing students and describing career opportunities in the Bureau. Significant results were achieved in the recruitment of foresters by means of an agreement between the Department of the Interior and the Civil Service Commission. Under the terms of the agreement, the Bureau was authorized to conduct Civil Service examinations in the colleges and to offer appointments to qualified students.

Employment in the Bureau as of June 30, 1957, totaled 2,856, distributed as follows: Area 1, 817; Area 2, 764; Area 3, 733; Area 4, 222; Eastern States Office, 52; and Director's Office, 268.

FINANCE

Receipts from the management of public lands in fiscal year 1957 amounted to $112,059,358. This amount included $2,208,703 from rents and royalties on the Outer Continental Shelf and $109,850,654 from public-land receipts. This is a decrease of $100,157,164 below the prior fiscal year as no leases on the Outer Continental Shelf lands were issued. As a result, revenue was placed in escrow pending final decision on the boundary of the Outer Continental Shelf lands. The receipts of $109,850,654 from public lands were an all-time high, the previous high being $100,992,667 in fiscal year 1956. Of the total amount, $38,700,056 was distributed to States and counties. The receipts were from varied sources, principally from oil and gas leasing, timber and land sales, and permits and leases.

Obligations incurred for operations during fiscal year 1957 amounted to $23,776,153.

THE NATIONAL PARK SERVICE

Conrad L. Wirth, *Director*

NINETEEN FIFTY-SEVEN will go down in the history of the National Park Service and the National Park System as a notable year principally because it saw the actual launching of Mission 66. It was a gratifying year in that it gave the Service its great opportunity to put park conservation into practice in a manner and on a scale befitting the character of the National Park System. It was a challenging year in its demand that this opportunity be met wisely and economically.

Many other events helped to make the year an unusual one. One of these was the establishment of the 29th national park—Virgin Islands—through the far-seeing generosity of the family of Mr. John D. Rockefeller, Jr. Another was the completion of the Colonial Parkway and of new visitor centers at Jamestown and Yorktown, in Colonial National Historical Park, Va., in time to serve the thousands of visitors to the Jamestown-Williamsburg-Yorktown Celebration. The charm and beauty of the parkway and the effectiveness of the visitor centers have occasioned much favorable comment, as has the glassmaking plant established and operated at Jamestown by the Jamestown Glasshouse Foundation.

The results of 2 years of painstaking study of the Atlantic and Gulf coasts saw expression, early in the year, in the publication of a popular version of the official report, entitled "Our Vanishing Shoreline." This handsome, well-illustrated brochure was given wide and effective distribution and has made large numbers of Americans aware of the loss they face unless effective steps are taken, and quickly, to preserve some of the remaining sections of still unspoiled shoreline against the invasion of commercial resorts and private home construction. The anonymous donor of the funds which paid the cost of the study and the issuance of the brochure was so pleased with the widely favorable response to it that he provided additional funds with which to conduct similar studies, now well under way, of the shores of the Pacific Coast and the Great Lakes.

There is great satisfaction in the realization that the Nationa Park System continued to be the object of such acts of generosity a those listed. To them should be added: The donation of $400,000 b Jackson Hole Preserve, Inc., to match a similar amount of appropriated funds for land purchases; an anonymous donation to permi the Service to acquire greatly needed additional lands for the Wrigh Brothers Memorial at Kitty Hawk, N. C.; and an additional donatio of $200,000 from the Avalon and Old Dominion Foundations for th purchase of Cape Hatteras National Seashore lands.

Mission 66

The Service is eager to carry forward the Mission 66 program a rapidly as the Congress provides the funds for it, but it is equall eager that every element of it be the result of sound, basic plannin and of functionally sound design. Though the year brought fund for a greatly expanded program of construction of buildings an utilities, and though progress was made difficult by the scarcity o personnel in the design professions, the accomplishment in design contracting, and construction was one of which the Service has ever reason to feel proud.

The public attitude toward Mission 66 continues to be almost universally favorable. The major exception is in western Washington where newspapers, chambers of commerce, and the Automobile Club of Washington have been highly critical of the Service's program fo Mount Rainier National Park. This program proposes the ultimate elimination of overnight accommodations from the high altitude and deep winter snows of Paradise Valley and the compensating provision of accommodations at lower elevations, for which feasible sites were designated after careful study of all possibilities. It proposes also the removal of park headquarters facilities, so far as that is feasible, from a dangerous and limited area at Longmire to a site to be selected near Ashford, outside the park. This plan would make more space available at Longmire for picnicking and camping; it would, it is believed, also permit such long term economies in operation as to justify it from that standpoint.

Opponents of the elimination of overnight accommodations at Paradise hope that the Government, which bought out the existing and outmoded facilities of the Rainier National Park Co. several years ago, will replace them with others of more modern type. It is generally agreed that private capital considers such an investment too great a risk for it to undertake.

Late in the year the Service also announced the principal features of its program for Yosemite National Park. One proposal of major

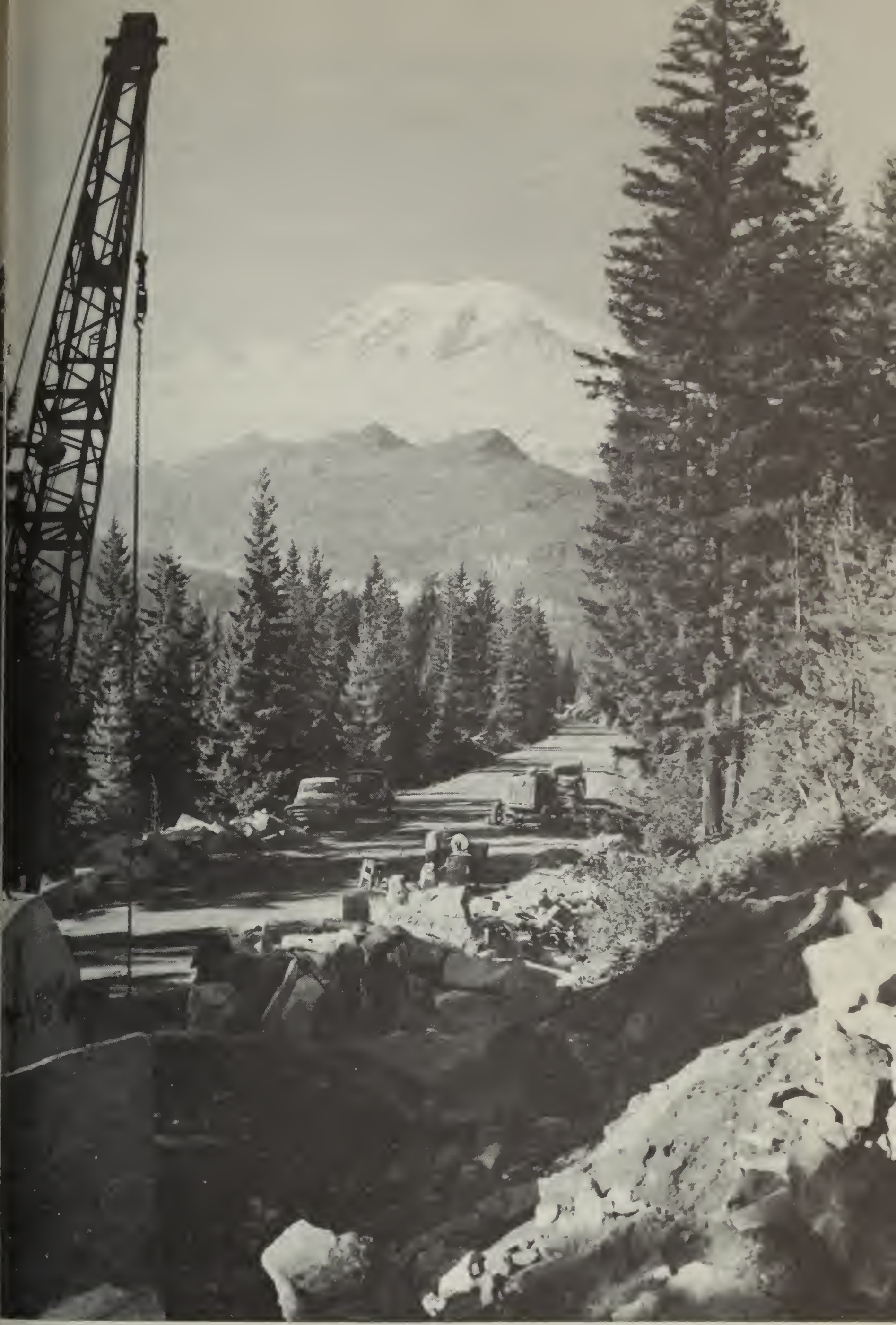


FIGURE 27.—Construction work on the Stevens Canyon Road at Backbone Ridge with spectacular Mount Rainier in the background. Started in 1931, grading was nearly completed when work was suspended on account of World War II, and was not resumed until 1949. Under the National Park Service Mission 66 program, this $4,784,000 highway was completed late this summer (1957).

importance looks to the removal of many park operations from th floor of Yosemite Valley to a new administrative site at El Portal just outside the Arch Rock entrance, thus relieving the valley of certain activities which can be carried on as well elsewhere, and of many structures, most of which are old and obsolescent, or worse.

Concessioner Developments

With funds available to the Service to bring in utilities, and to construct needed access roads, parking areas, and paths, provision of additional concession facilities have been materially stepped up in a dozen areas. Most notable among these was the opening of the new Canyon Village in Yellowstone with 500 guestrooms, lodge, stores and campgrounds, and completion of some 89 new cabins at Colter Bay, in Grand Teton, as well as appurtenant facilities. A new lodge was opened in Yosemite and extensive cabin developments are under way at Grand Canyon, Shenandoah, Everglades, Glacier, Lassen, and Virgin Islands National Parks.

Training Center

A milestone in the Service's effort to supply effective training to its employees was passed when the Congress approved the proposal to establish a training center for career-conditional uniformed employees at Yosemite National Park on a 3-year trial basis. Both staff increases as Mission 66 progresses, and earlier retirements because of liberalized retirement legislation, make it vitally necessary that new park rangers, historians, naturalists, and archeologists, early in their careers, become soundly grounded in Service history, policies, and practices. Each year, some 50 men and women, attending 3-month training periods, may be expected to find their niches in the organization much more rapidly and surely than has been possible in the past.

Advisory Board

Two members of great distinction were appointed to the Advisory Board on National Parks, Historic Sites, Buildings, and Monuments upon the expiration of the terms of Maj. Gen. Ulysses S. Grant, III, and Dean Turpin C. Bannister of the College of Architecture and Fine Arts of the University of Florida. They were Dr. John Allen Krout, vice president and provost of Columbia University, and Earl Howell Reed, Chicago architect. Dr. Krout, teacher and writer of history, and Mr. Reed are expected to contribute greatly to the solution of problems involved in the preservation of historic sites and buildings, an important Mission 66 objective. Throughout their terms on the Board, both General Grant and Dr. Bannister contributed valuably to its deliberations.

Florida Problems

Final action had not been taken, by the end of the fiscal year, on legislation solidly backed by Florida's Senators and Representatives, to establish final boundaries for Everglades National Park. While this legislation would eliminate certain lands from the northeastern part of the park, it would add others of great importance in the Ten Thousand Islands area, and provide a fully protected water corridor from the northwest. An earlier decision not to permit construction of overnight accommodations at Flamingo, on Florida Bay, was modified because of the conviction that they were needed so that park visitors might gain full enjoyment of the park, especially on boat trips requiring a very early morning start.

A troubling problem, for which the Service is seeking a satisfactory alternative, is posed by a proposal to use some of the already limited lands of Castillo de San Marcos National Monument as right-of-way for a widened State highway.

Dedication of Virgin Islands National Park

The 84th Congress, near the close of its 1956 session, authorized the establishment of Virgin Islands National Park, to include the major portion of St. John Island, as the 29th national park, subject to Federal ownership of not less than 5,000 acres of land within its ultimate boundaries. Deeds for slightly more than that acreage having been tendered by Laurance F. Rockefeller, in behalf of Jackson Hole Preserve, Inc., of which he is president, the newest national park was dedicated with appropriate ceremonies at Cruz Bay, on St. John Island, on December 1, 1956. Speakers included Mr. Rockefeller, Secretary of the Interior Fred A. Seaton, and Governor Walter A. Gordon of the Virgin Islands. The Director of the National Park Service was master of ceremonies. Guests at the dedication ceremony included the Governor and other Territorial officials, a number of residents of the Islands, and special guests—including numerous newspaper and magazine representatives—brought from the mainland by Jackson Hole Preserve.

Harold A. Hubler, until then superintendent of San Juan National Historic Site, was appointed the first superintendent of the new park, but also retains jurisdiction over the historic site.

Figure 28.—Left to right, Conrad L. Wirth, Director of National Parks: Fred A. Seaton, Secretary of the Interior, and Laurance S. Rockefeller at the newly dedicated Virgin Islands National Park, December 1, 1956. This 29th national park was made possible by the generosity and foresight of Mr. Rockefeller who acquired, and presented to the Government, the major portion of the Island of St. John.

nterpretation

The visitor center "idea," to provide one or more focal points for nformation and interpretation in most of the areas of the system vhich need them, has proved itself, if one may judge from the mmediate public response to those opened during the year at Jamesown, Yorktown, and Grand Canyon. Though such facilities offer erhaps the most noticeable advance in meeting the interpretive task, ll phases of interpretation, self-guidance, the use of audio-visual naterials, more and better literature, roadside signs, markers, and xhibits, and the preparation of museum exhibits—have made excellent rogress.

It is particularly gratifying to record that the University of North arolina Press is to publish "Interpreting Our Heritage," the book y Freeman Tilden, which records the results of his 2 years of study f interpretive methods and practices, undertaken with anonymously onated funds.

egislative History

When long-time Superintendent Edmund Rogers left Yellowstone ast autumn, he started giving full time to completion of an exhaustive egislative history of all the areas of the National Park System, a roject which had been a part-time and valuable hobby of his for nany years. It is expected that it will take 2 years to finish the ecessary research and to put the large amount of material in shape or use.

Motion Pictures

Two motion pictures of exceptional quality dealing with national arks appeared during the past year. "National Parks, Nature's Last rontier," produced by Martin Bovey, is to be distributed by Minneapolis-Moline; it deals perceptively with the National Park System s a whole. "Yosemite, Valley of Light," is the title of a film produced by the Ford Motor Co., and is perhaps as fine a pictorial treatnent as has ever been made of a single park.

"The People's Heritage," produced 2 years ago by the Craven Film orp., with photography by John H. Storer, deals with the beauty nd inspiration of the national parks and some of the problems they face. With anonymously donated funds, this film has been updated nd "tied in" with Mission 66 and 50 copies were obtained for use in onnection with the interpretive work of the Service.

Catastrophe

Grand Canyon National Park was the scene of the worst commercia airline disaster on record on June 30, 1956, when United and TW airliners carrying 128 persons collided and crashed in the isolate eastern end of the Canyon, with the loss of all on board. Immediate following the discovery of the wreckage, the park staff became involved in one of the most difficult rescue and recovery operations i its history. Air Force and Army provided helicopters and require personnel, while Superintendent McLaughlin and his staff furnishe advice and guidance in reaching the crash sites. For nearly 2 week park personnel were busy assisting in recovery operations and working with newspaper and magazine people from all over the world wh came to cover the story.

The area where the wreckage lies is still closed to the public.

General Grant Tree Becomes National Shrine

Some 4,000 persons were present when the General Grant Tree, i Kings Canyon National Park, which has long been known as th Nation's Christmas Tree, was dedicated as a national shrine, pursuant to an act of Congress. Adm. Chester Nimitz, retired, representing President Eisenhower, was the principal speaker. The America Legion of Sanger, Calif., and the Service jointly sponsored th ceremony.

Bryce Canyon and Zion Administration Separated

Nearly 28 years after its establishment as a national park, Bryce Canyon became a separate administrative unit on July 1, 1956. Previously, it had been administered jointly with Zion National Park.

Winter Use

Winter visitation in the eight national parks which offer limited facilities for snow sports continues to increase, with 411,851 last winter as compared with 361,760 the previous winter. Some 40 percent of visitors participate in skiing, skating, and sliding; the others come to enjoy the winter scene, so completely different in appearance from that viewed by those who come in other seasons. An interpretive program inaugurated at Hidden Valley, in Rocky Mountain National Park, was well received. Improved and expanded interpretive exhibits and information services were provided generally in these winter-use parks.

ountain Climbing

The summit of Longs Peak, in Rocky Mountain National Park, was ached last summer by 1,596 persons; it is the most popular climb in e National Park System. At Grand Teton National Park, 1,644 imbers made successful ascents, 477 climbing Grand Teton. Mount ainier—boasting a revised elevation of 14,410 feet, up 2 feet—was scended by 406 persons. In its 50th anniversary year as a national onument, Devils Tower had the heaviest climbing season in its story, with 123 individuals attaining its summit.

Only one fatality directly associated with mountain climbing curred in the National Park System.

iver Running

Trips by boat down the rivers of Dinosaur National Monument have ow given several thousand people, of all ages, an opportunity to view s magnificent canyons from water level; 762 visitors made boat ips there last year. Regular boat trips down the Snake River from oran to Moose in Grand Teton National Park, started last summer, ttracted 900 patrons, and probably 300 others made the trip in rivate boats.

While the Colorado, on its course through Grand Canyon National ark and Monument and Lake Mead National Recreation Area, does ot attract so many river runners, the number of boat trips from Lees erry to near Boulder City continues to increase.

pecial Observances

President Theodore Roosevelt first made use of the authority ranted him by the Act for the Protection of American Antiquities o establish national monuments by proclamation to give that status o Devils Tower in Wyoming. The 50th anniversary of his action—ugust 24, 1956—was observed at Devils Tower with appropriate eremonies at which Secretary Seaton was the principal speaker. he Post Office Department issued a commemorative postage stamp, epicting the tower, in honor of the anniversary and it was first laced on sale at the monument post office on that date.

New developments at Colter Bay, Grand Teton National Park, ere shown to the public at an open house there on June 16, at which ime also a plaque commemorating the explorations of John Colter nd his discovery of the Tetons 150 years ago was unveiled. Erec-ion of the plaque was jointly sponsored by the Wyoming State His-orical Society and the National Park Service.

"Campfire Day," September 19, was observed widely throughou the Service, primarily by and for Service concessioner employee It was on September 19, 1870, that the proposal was made around th evening campfire of the Washburn-Langford-Doane expedition tha the Yellowstone be set aside as a national park. August 25 is th anniversary date of the passage of the Act establishing the Nationa Park Service; 1956 was the 40th anniversary year. Designated a Founders' Day, observance of the anniversary provided an oppor tunity for park staff to acquaint many thousands of visitors wit something of the history and ideals of the Service.

Protection of Park Wilderness

The Mission 66 report, completed in mid-1956, made plain th Service's continuing concern for the protection of wilderness in th National Park System. In order to provide information to thos interested in this phase of national park administration, the Servic produced and distributed rather widely a statement entitled "Preservation of Natural and Wilderness Values in the National Park System." The same subject matter, in somewhat shortened form, i to be presented in a handsome brochure, to be entitled "The National Park Wilderness." Funds donated for the purpose will defray the costs of production. It will be in a format similar to that adopted for "Our Heritage" and "Our Vanishing Shoreline."

PROGRESS ON MISSION 66

The Mission 66 program has reached its first anniversary, and orderly progress can be reported as being right on schedule.

The major accomplishment of the Mission 66 staff during the year has been the review and approval of the final Mission 66 prospectuses for each area of the National Park System. These prospectuses are complete guiding documents which define the purpose, objectives, and plans for management, development, protection, and use of each area during the period of Mission 66. The prospectuses are still subject to minor revisions, refinements, or additions to improve the program or to adjust to changing conditions.

Brief editions of many park prospectuses were prepared and made available for distribution. These individual briefs have been valuable in gaining general public understanding of the program and in sustaining interest and support for its completion.

Public reaction to Mission 66 has been warm in its praise, and excellent newspaper coverage has featured articles on the general program as well as on individual area development projects. Anniversary celebrations, dedications, talks to service groups, area "show ıe" days, and press releases on individual area programs have kept Iission 66 before the public. It has greatly heightened public interest ı conservation and recreation generally.

The third series of slide presentations, Mission 66 in Action, illusrating progress and accomplishments, was made available to field ffices. The illustrations, assembled from a wide choice of colored lides showing current field progress in Mission 66 projects, and used ı conjunction with a recording carrying the Director's commentary, ere duplicated in quantity and widely used by field areas to keep the ublic fully informed about details of the Mission 66 program and to how significant progress in the accomplishment of its aims.

Two additional booklets have been prepared by the staff and will be eleased early in the fiscal year. These are the first annual progress eport, Mission 66 in Action, and an illustrated presentation of the Vilderness Statement, a long-needed statement discussing the objecives, principles, and practices relating to the preservation of wilderıess qualities in areas within the National Park System, reviewing the ains achieved over some 80 years of national park history, and preenting the plans which will insure the preservation of these essential ualities in the years ahead. The publication of these booklets was ıade possible by private funds donated by a friend of the Service.

The Mission 66 staff met with representatives of the United States orest Service and the Fish and Wildlife Service, at their request, to eview steps taken in the organization of Mission 66 as an aid in the ormulation of similar type programs for their organizations.

The Mission 66 advisory committee of nine members chosen from ield areas and the Washington Office continued to meet, as necessary, o make objective analyses of conclusions reached by the Mission 66 taff, and to provide the staff with suggestions, advice, and reactions epresenting the entire Service. To assure an active, alert committee, otation of membership was placed on a 2-year basis and three memers were replaced this year.

Work began on the development of a national recreation plan, one f the major objectives of the Mission 66 program. Included in this road plan are a number of special studies. These include a national urvey of outdoor recreation resources—a national plan for providing ıonurban outdoor recreation resources at local, State, and national evels, with suggested procedures for accomplishment; the Historic ites Survey, which will complete the national inventory of historical ınd archeological sites that should be preserved; and the Historic American Buildings Survey, which will be resumed to record and reserve measured drawings and photographs of existing monuments f the builders' art in the United States.

Mission 66 Legislation

Identical bills have been introduced in the 85th Congress, both i the House and the Senate, to implement Mission 66.

Generally the bills would authorize construction on Federal land adjacent to but outside areas of the National Park System with th consent of the agency administering the land. They would clarif the authority for expending land funds on such incidental items a surveys, summaries, and appraisals. The would also permit the Service to obtain critical, expert, or consulting services without regard t the usual requirements for advertising and compliance with Civi Service Commission and classification regulations.

DESIGN AND CONSTRUCTION

Employment

Continued progress has been made in the staffing of the Field Design Offices. It is believed that the professional working force can now be maintained at an adequate level.

The student trainee and assistant programs have been fully utilized. In the summer of 1956 approximately 90 student architects, engineers, and landscape architects were on duty with the Western Office of Design and Construction and about 75 with the Eastern Office. The majority of these students were assigned to projects in the parks and monuments.

The work done by Public Health Service engineer reserve officers assigned to WODC and EODC in lieu of engineering vacancies has proved very effective.

Construction Funds

A great deal of credit is due the Design and Construction Division for advancing a sound economical construction program. Work progressed very satisfactorily and at the end of the fiscal year over 92 percent of the total construction funds apportioned for the year had been obligated or committed and some of the projects in the 1958 fiscal year program were being advertised.

Roads and Trails

Mission 66 accomplishments under the Bureau of Public Roads portion of the 1957 roads and trails program include the completion of 25 construction projects in 17 parks. Total obligations for these projects were $9,242,415. Of this amount, $7,393,932 was obligated directly for construction. Accomplishments include the completion

construction of 7.761 miles of new roads, 2.129 miles of road in
age construction status, 98.496 miles of reconstruction of old roads,
ie building of 13 bridges, and such miscellaneous items as parking
reas, guardrails, and tunnel linings.

Work completed under the minor road and trail program, ad-
inistered and engineered exclusively by the Service, cost approxi-
ately $2,400,000. It included the completion of approximately 39
iles of new road, 21 miles of stage construction on additional new
ads, and reconstruction work on aproximately 180 miles of old
ads. In addition, work was completed on 25 miles of new trails and
construction on 32.5 miles of existing trails. The new mileage com-
leted and under construction will provide initial developments in
umberland Gap National Historical Park, as well as access to new
isitor facilities at Cosby Campground at Great Smoky Mountains
ational Park, the new Canyon Village at Yellowstone National
ark, and several new visitor facility developments at Lake Mead
ational Recreation Area and Cape Hatteras National Seashore
ecreational Area.

arkways

In the first year under the Mission 66 program, an $11 million con-
act authorization provided by the Federal Aid Highway Act of
956 advanced construction on national parkways. Of this amount,
3,719,400 was for the Blue Ridge Parkway in North Carolina and
irginia, $80,000 for the Chesapeake and Ohio Canal in Maryland,
610,500 for the Foothills Parkway in Tennessee, $2,156,400 for the
eorge Washington Memorial Parkway in Maryland and Virginia,
4,233,700 for the Natchez Trace Parkway in Mississippi and Ten-
essee, and $200,000 for advance planning. These funds were con-
entrated on closing gaps in parkways construction and on additional
ublic service facilities in developed areas.

Major parkways construction reached its highest volume since the
rogram was begun in 1933. As of June 30, 1957, approximately
17,600,000 worth of contracts were in process under the Bureau of
ublic Roads program, including 92 miles of grading and base course,
7 bridges, 7 grade separations, tunnel lining, slope stabilization, and
uardwalls.

Major parkway contracts costing approximately $8 million were
ompleted on 24 major projects, including 29 miles of grading, 22
ridges or grade separations, 30 miles of final paving, tunnel lining,
uardrail, and other work.

Approximately $8 million was expended to complete the 23-mile
olonial Parkway connecting Yorktown and Jamestown in time for
ie 350th anniversary celebration.

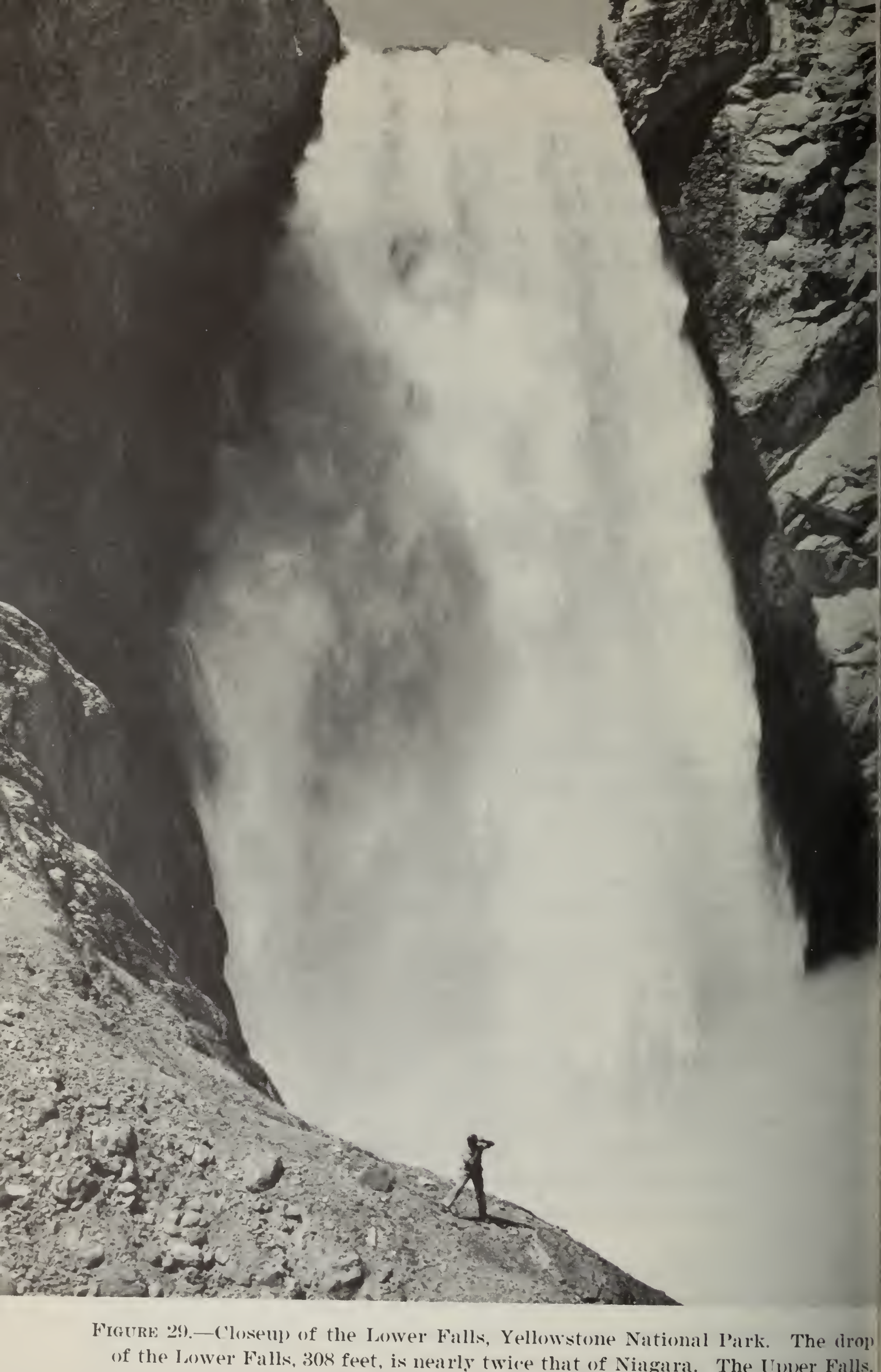


FIGURE 29.—Closeup of the Lower Falls, Yellowstone National Park. The drop of the Lower Falls, 308 feet, is nearly twice that of Niagara. The Upper Falls, not far above, drops 109 feet with a thundering roar. Note the photographer down in the canyon near the base of the Lower Falls.

Master Plans

Adjustments in the master plans are proceeding as a logical step subsequent to the approval of Mission 66 prospectuses.

The preparation of master plans before construction drawings are prepared is essential to assure logical and economical development. Therefore, our objective is to advance the master plans well ahead of the current construction program. We have made some progress in the past year in catching up with the backlog and further improvement is anticipated. During the 1957 fiscal year 134 master plan drawings were approved. In addition 388 preliminary studies were prepared.

Buildings

One of the principal and most effective phases of the provision of Mission 66 has been buildings essential for public service. Facilities for making the visits to national parks more enjoyable and to provide for their comfort and convenience is nowhere more apparent than in the buildings program. The first year of Mission 66 has seen completed and put in operation visitor centers at Jamestown and Yorktown in Colonial National Historical Park, Grand Canyon, Carlsbad Caverns, and Olympic National Parks, Fort Frederica National Monument and Fort Caroline National Memorial, and a library addition at Morristown National Historical Park. Work is in progress on visitor centers at Chalmette National Historical Park, at Everglades, at Colter Bay in Grand Teton, and at Canyon in Yellowstone National Parks, and at Dinosaur, Chaco Canyon, and Organ Pipe Cactus National Monuments. Plans are in preparation, with early contracts expected, for like structures at Grand Teton and Mammoth Cave National Parks, and Craters of the Moon National Monument. At Mount Rushmore an amphitheater for 1,800 persons, complete with audiovisual equipment, has also been completed and soon will be placed in use. Two lodging units containing 32 rooms with baths have been completed at Isle Royale National Park and a large concessions building with restaurant, lounge, and other facilities at Mount Rushmore National Memorial.

Modern comfort stations have been constructed in new and enlarged campgrounds in Grand Teton, Yellowstone, Everglades, and many other parks and monuments; 56 such buildings were completed, with 25 others under construction or ready for contracting. Of lesser interest but essential to the operation and protection of the parks are 9 new administrative facilities, 24 maintenance buildings, and 103 employee housing units completed or in course of construction with a number more in the planning stages.

Notable progress has been made on the reconstruction of historic buildings. Work has been completed or is underway at Independence Hall where new electric, fire alarm, and heating systems have been installed, new public restrooms provided, and general rehabilitation work accomplished. Nonhistoric buildings within Independence National Historical Park are being demolished to provide a proper setting for the historic buildings. Basic architectural research, reports, and measured drawings of historic buildings have been made at Adams, Harpers Ferry, Appomattox Court House, Andrew Johnson, Hampton, and Fort Laramie, and restoration work has been completed on some of the buildings.

The concessioners in Yellowstone, Grand Canyon, Grand Teton, and Glacier National Parks have kept pace with the Service in providing new and improved facilities in the form of stores, lodges, and overnight accommodations for visitors, and dormitories for their employees. The Service has installed the utilities and constructed the roads, trails, and parking areas to serve these improvements.

Utilities and Miscellaneous Structures

Construction for the first year of Mission 66 included the completion of 48 water system projects costing approximately $1,825,000, and providing a net increase in available water storage of about 3,850,000 gallons; 38 sewer system projects representing an investment in new facilities of about $713,967; new marine structures including several small piers, docks, floats, and a mile of shoreline protection at Colonial National Historical Park costing $280,000; extensive sand fixation at Cape Hatteras amounting to $102,270; and major repair and restoration of the Victory Monument at Yorktown, Virginia, at a cost of $205,334.

Negotiations were also completed for the borrowing of 500 tons of airplane landing mat sections from the Navy Department, Bureau of Yards and Docks, which were in turn lent to the State of North Carolina for interim stabilization of several miles of road through a portion of Cape Hatteras National Seashore Recreational Area.

Through the medium of the cooperative agreement with the Public Health Service and the extensive research facilities of that Service a study and analysis of present sewerage facilities and future needs at Mammoth Cave National Park was completed. By this means a quantity of newly developed technical data was accumulated, useful in developing improved design criteria in the field of sanitary engineering.

A comprehensive study of electric generating and distribution systems and future requirements at Yellowstone National Park was nade. A complete new set of specifications for purchase of NPS requency-modulated radiophones and accessories was prepared and listributed. The Service's radio testing facilities were discontinued nd arrangements made for the Forest Service to test and certify our future radio equipment at considerable savings.

Civil Defense

The Division of Design and Construction participated actively in peration Alert 1956 under a preplanned decentralized Emergency Operations Organization coordinated with the departmental program.

INTERPRETATION

The National Park Service's success in meeting its responsibilities s trustee for the 182 areas it administers is gaged more by the effectiveness of its work of interpretation than by any other phase of its ctivities.

Not only does Mission 66 recognize this fact fully; already its results in enlarged and improved interpretive facilities are evident in number of locations, and the coming year will see still further advances. Hand in hand with these physical improvements goes a constant search for better means and more effective methods; staffing pproaches closer to adequacy for the tasks which we face; planning for the future becomes more exact and seeks full coordination with the provision of facilities.

Services to the Public

Increases in both facilities and staffs resulted in increases in the numbers of persons receiving interpretive services at a higher rate than the gain in total numbers of visitors. The count of interpretive services was nearly equal to the number of visitors to those areas where such services were offered (98 percent) by contrast with the preceding year when it was 91 percent. The greatest rate of gain was at visitor centers and other attended stations which recorded an increase of 4,700,000 to a total of almost 18 million. Over 5 million persons heard campfire or orientation talks and 2,285,000 took conducted trips led by trained naturalists and historians.

Staffing

Increases in permanent interpretive employees included a chief park naturalist at Bryce Canyon, assistants at Mammoth Cave and Hawaii National Parks, and historians at Mount Rushmore, Fort

Laramie, and Jefferson National Expansion Memorial. There was also some increase in seasonal ranger naturalists, historians and archeologists. Increases in park ranger and maintenance staffs have helped, by relieving interpretive staffs of some of their extraneous duties.

Visitor Centers

Outstanding among the many useful ideas that have resulted from the creative and forward-looking thinking of Mission 66 has been the visitor center which provides, at one or more places in each field area, focal points for informational and interpretive services.

Such a center, constructed during the year at Grand Canyon well illustrates the principles which apply to location, arrangement and content. It is situated on the main park road a few miles inside the south entrance, past the overlook where most visitors get their first, breathtaking view of the Canyon itself.

In the lobby, the visitor finds an information desk manned by a uniformed ranger equipped to answer their questions and to provide them with literature and maps. Lobby exhibits suggest the significance and extent of the park.

In a room across the patio a brief, continuous illustrated talk will help him plan his visit wisely. Or he may step into the park museum where a great variety of exhibits, arranged in orderly and effective fashion, enable him to obtain a more complete story of the canyon—both its natural and human history.

The center is headquarters for the park's whole interpretive program. Here the park naturalist has his office; here are the study collections, naturalist workshop, and library. The visitor is welcome to make use of the library, and the student to consult the study collections.

Here, too, the superintendent has an office where he can maintain contact with those who come to the park. In effect a one-stop service unit, it functions effectively and economically.

The Jamestown and Yorktown visitor centers, situated at opposite ends of the Colonial Parkway, were opened in time for the Jamestown Festival, celebrating the 350th anniversary of the founding of the colony of Virginia. Each offers information facilities, an auditorium, and a museum. The Yorktown center contains also the park's headquarters. The center at Jamestown is shared with the Association for the Preservation of Virginia Antiquities which owns part of Jamestown Island, and here are housed the park's extraordinarily rich study collections. Having learned where to look, what to ee, and something of what happened here, the visitor may walk irectly to sites of great historic interest.

The Jamestown museum makes effective use of objects excavated at he townsite and of corresponding 17th century specimens from Euope to tell the story of the island and the colony. Among the exhibits n the Yorktown museum are the two tents which George Washington ised throughout the Revolution. The large dining tent was used at orktown in 1781 for the banquet Washington gave the British offiers after the surrender.

Sixteen other visitor centers were under construction or completed uring the year. Planning and preparation of exhibits kept pace as losely as possible with building construction. However, for more apid production of exhibits, plans were made for opening a second useum laboratory in San Francisco as soon as space for it is vailable.

oadside Interpretation

In both scenic-scientific and historical areas of the National Park ystem, progress in providing interpretive signs, markers and exibits along both new and old roads attests the Service conviction that nly when these have been provided can a park road be said to be omplete. New roads approaching completion—the highway along he east side of Jackson Hole in Grand Teton National Park, the tevens Canyon Road in Mount Rainier National Park, and the eart-of-the-Hills Road in Olympic National Park, for examples—ill be equipped to provide such opportunities.

A distinctive series of interpretive markers was placed on the just-ompleted Colonial Parkway, in Colonial National Historical Park. oadside interpretive painting exhibits along the Jamestown Loop our Road are a decided innovation. Interpretation of the "New owne" section of Jamestown makes use of partly restored fences, edgerows, and ditches, a series of reconstruction drawings, markers, nd recordings. There are significant new marker installations and ther interpretive devices at Acadia, Wind Cave and Grand Canyon ational Parks, Badlands, Colorado, Dinosaur, Black Canyon of the unnison and Wupatki National Monuments, Theodore Roosevelt ational Memorial Park, and Kennesaw Mountain National Battleield Park.

A committee representing the Divisions of Interpretation and of esign and Construction has formulated a set of guidelines and standrds to help field areas in developing and installing roadside interretive facilities. These are scheduled for early publication.

Self-Guidance

The annually increasing numbers of visitors to the parks continues to require the expansion of the system of self-guiding trails and, less numerous, roads. Self-guiding trails marked by numbered stations with references to a printed booklet or folder now number more than 100; they serve immense numbers of visitors whose schedules do not permit them to take conducted trips or who prefer more leisurely exploration of the trails. Three new self-guiding trails have been installed in Yosemite, and one each in Great Smoky Mountains National Park, and at Colorado, Devils Tower, Fort Union, Coronado, and El Morro National Monuments, Theodore Roosevelt National Memorial Park, and Kennesaw Mountain National Battlefield Park.

An important interpretive accomplishment was the establishment of a self-guiding tour system for the battlefields of Fredericksburg, Chancellorsville, The Wilderness, and Spotsylvania Courthouse. At Castillo de San Marcos National Monument a series of visitor-activated recordings of brief interpretive talks have become the major medium of interpretation. In Independence Hall, exhibits placed in the Supreme Court Chamber and the East Wing have helped visitors to grasp the Service's restoration program in progress there.

Self-Guidance Publications

There has been a noticeable and steady improvement in both the appearance and the content of self-guidance publications. Earlier mimeographed sheets are being replaced by well-illustrated and well-printed booklets, with the Southwestern Monuments Association and Loomis Museum Association setting the pace. The Mountain Farm Trail booklet for the Blue Ridge Parkway and the Sunset Point Nature Trail booklet for Mammoth Cave National Park, produced by the Eastern National Park and Monument Association, an official cooperating society serving many areas in the East and South, well exemplify the progress being made in this specialized publications field. While some self-guidance publications are printed at the Government Printing Office, many more are produced by cooperating organizations.

Use of Audiovisual Devices

There was an increase of more than 50 percent in the use of audiovisual aids to supplement personal services in interpretation throughout the National Park System during the year. An audiovisual committee of the Division of Interpretation gave direction to the planning involved in this expanded activity and to the programing

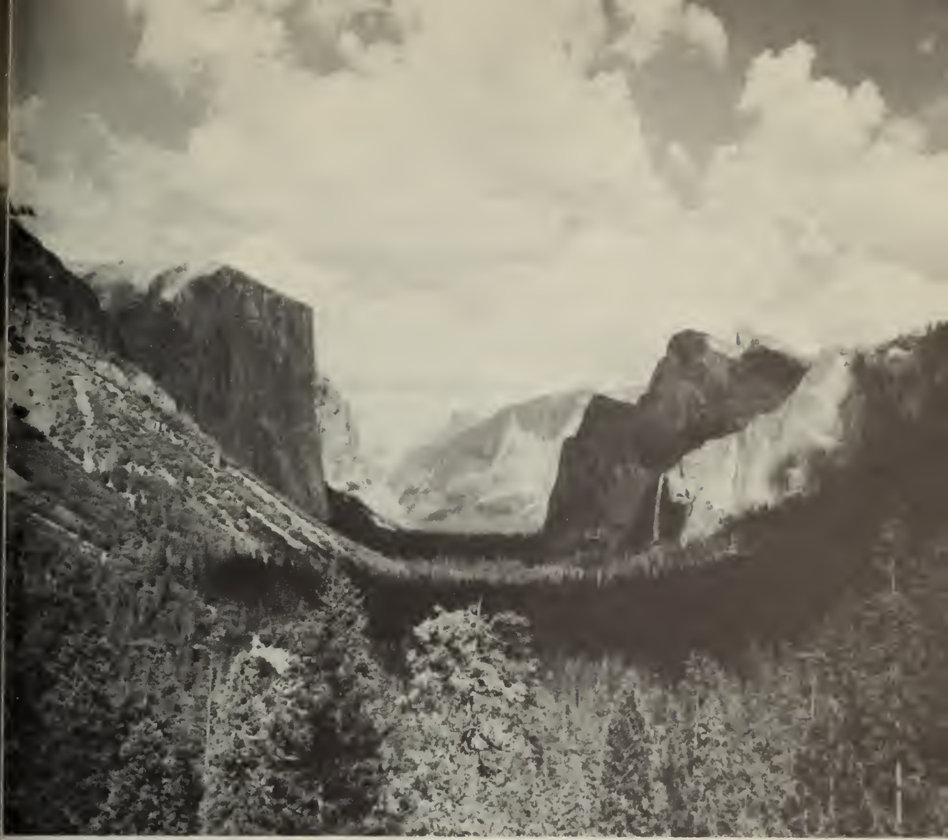


FIGURE 30.—Yosemite Valley from the Wawona Road Tunnel looks practically the same as it did when the first white explorers in pursuit of Indians entered the Valley in 1851. From this point no trace of human development may be seen although the view encompasses much of the seven-mile long Valley with El Capitan rising 3,604 feet on the left, Clouds Rest and Half Dome in the distance, and Cathedral Rocks and Bridalveil Fall appear on the right.

of Mission 66 construction funds for it. Ten different types of installations, in 52 separate units, were placed in operation. Included among these types were: Automatic devices, including "talking labels"; outdoor electronic self-guiding systems; 30-slide capacity, console-type slide projectors; an experimental, 60-slide capacity, dissolve-face projection and sound system; 16 mm. optical-magnetic film projectors combined with public address systems; semiautomatic slide-projector-tape recorder units, with synchronized sound; and magnetic tape-recorder reproducers.

"Talking labels" have been used in connection with dioramas and electric maps in museums and for brief interpretive talks. Much improved slide-sound installations have already abundantly proved their usefulness in presenting "What to see and do" talks in several new visitor centers.

With the help of regional offices and the superintendents and their interpretive staffs, it was possible to improve the annual programing of audiovisual installations to meet urgent needs, especially for the new visitor centers, amphitheaters, and campfire circles being provided under the Mission 66 program.

Historical Restorations and Demonstrations

The year saw the beginning and, in several instances, the accomplishment of varied and important projects for restoration of historic structures and their surroundings to conditions closely approximating those of the time commemorated by them. Attracting probably the greatest amount of public attention and acclaim was the 17th century-type glasshouse built at Glasshouse Point, Colonial National Historical Park, by the Jamestown Glasshouse Foundation, Inc., and placed in operation for the actual blowing of glass containers on April 1. The foundation was established by the leading glassmaking companies of the United States.

At Jamestown also the completion of the Colonial Parkway included the restoration of the isthmus which connected Jamestown with the mainland from 1607 until the American Revolution.

At Hopewell Village National Historic Site, in Pennsylvania, the obtrusive modern road which bisected the old iron-furnace village was eliminated; the historic landscape, grades, elevations, and slag roads were restored. On the Natchez Trace Parkway, Mount Locust, the one-time frontier home and inn, was restored and dedicated. A beginning was made on the restoration of the historic covered bridge at Wawona, in Yosemite National Park.

Excavations at Fort Sumter National Monument brought to light long-hidden portions of the old fort, which the public may now see for the first time in nearly a century. Excellent progress was made in stablizing officers and noncommissioned officers quarters at Fort Laramie National Monument.

Work on the restoration of the first floor of Independence Hall, in Independence National Historical Park, continued with the meticulous care that has been used from the beginning.

Research

In the National Park Service, research is one of the important means which enable it better to meet its responsibilities. Historical research is done largely by its own historians. In other fields it is accomplished in various ways. Service employees contribute importantly to it, but it leans heavily also on the cooperation of other

Federal agencies, State agencies, and publicly and privately supported institutions of higher learning.

During calendar year 1956, 160 research projects were performed by regular and seasonal members of the Service, collaborators and cooperating groups and individuals. Of these, 148 dealt directly with the areas administered by the National Park Service, 4 were in the category of investigations of proposed areas, and 8 were general research projects. Graduate students and staff members of 23 colleges and universities, and 4 private individuals participated in these projects. Five Federal agencies, 7 State agencies, and 3 professional societies also performed research or assisted field personnel in research projects.

Natural science research during the year dealt with such matters as siltation at Mammoth Cave National Park; the ecology of Florida Bay, in Everglades; hydrothermal phenomena at Yellowstone; and the ecology of high mountain meadows and other fragile environment in several National Parks. The Coastal Studies Institute of Louisiana State University and the Office of Naval Research cooperated in detailed research on the geology, botany, archeology, and history of Cape Hatteras National Seashore; North Carolina State College is doing further research there in biology. Seven major geological research projects were in progress in Death Valley National Monument alone.

Texas A. & M. College and the Texas Fish and Game Commission are participating in a 5-year study of Big Bend National Park ecology. Biological and geological studies are under way in Virgin Islands National Park, the University of Kansas and Princeton University cooperating.

Historical research included studies of the appearance and use of Independence Hall at various periods; of details of colonial life and land ownership at Jamestown; of the locations of specific features at Fort McHenry, a necessary basis on which to prepare development plans; and a study of the historic structures remaining at Harpers Ferry.

Archeological methods were employed at such historic places as Fort Frederica and Fort Union National Monuments, at Jamestown, at Independence and Cumberland Gap National Historical Parks, and, on a minor scale, at a number of other areas. Important archeological research was continued by the University of Colorado at Mesa Verde, by the University of Southern California at Death Valley, by the University of California at Yosemite, and by the Bishop Museum of Honolulu at the proposed City of Refuge National Historical Park. Washington University, St. Louis, cooperated in the effort to find the original site of Arkansas Post. Service archeologists excavated at the site of Fort Clatsop, in Oregon.

Under cooperative agreements, 16 universities and colleges and the Smithsonian Institution performed river-basin archeological salvage. In addition, the University of Utah, the School of American Research, and the Museum of Northern Arizona undertook such salvage in the Upper Colorado Basin. The Smithsonian, working at 11 reservoir sites with funds supplied by the Service, recorded more than 200 new archeological sites, excavated 19, and processed more than 179,000 excavated specimens.

The Problems of Wildlife

Visitor interest in the animals of the parks, and the important part played by the National Park System in maintaining wildlife populations in their natural environment require Mission 66 projects to avoid damage to habitats and yet assure the visitor opportunities to see, enjoy, and learn about the wildlife of the parks.

The needed stronger program of biological studies now being planned will include stronger cooperative relationships with the Fish and Wildlife Service and more cooperative research with other qualified organizations.

Protection of sufficient forage and range for the larger hoofed animals continues to be a major problem. Control of elk within range capacity has been carried on satisfactorily at Yellowstone, Grand Teton, Rocky Mountain and Wind Cave National Parks. Direct control is used only when outside hunting proves inadequate. Bison were reduced at Yellowstone and Wind Cave and at Colorado National Monument.

Bison reintroduced last fall in Theodore Roosevelt National Memorial Park came through the winter well. The animals were provided by the Fish and Wildlife Service from its Niobrara National Wildlife Refuge.

Varied problems continue to face the Service in protecting and managing wildlife resources. Black bears require constant attention to prevent personal injury and damage to property. Rare and endangered species, of which numerous kinds find refuge in the parks, deserve and get constant special attention.

Information on Mission 66

Wide public interest in all phases of Mission 66 placed far heavier than normal demands on the information staff of the Washington Office and on field and regional offices. Of the press releases it issued through the Department, more than 40 percent dealt directly with one phase or another of Mission 66. In addition, as a matter of public service, superintendents issued much information to the press on Mission 66 programs and activities on the areas in their charge.

Publications

New items among Service sales publications, which now number 90, included historical handbooks on Washington's Birthplace and Ocmulgee National Monuments and Chickamauga-Chattanooga National Military Park; the Saguaro Natural History Handbook; and a new Archeological Research Series item, Archeology of the Funeral Mound, Ocmulgee National Monument, Ga. Eight new informational publications were produced for areas or features which previously had had none. A 32-page booklet on the park system of the National Capital replaced one of half that size. New format booklets were produced for Yellowstone, Yosemite, Grand Teton and Bryce Canyon National Parks.

Revisions of all Service publications, free or sales, dealing with Colonial National Historical Park, were issued to meet the needs of those attending the Jamestown-Williamsburg-Yorktown celebration. A new sales publication, "New Discoveries at Jamestown," embodied the results of extensive archeological excavations there over a 2-year period.

The 125 free informational publications ordered during the year totaled 8,778,000 pieces of printed matter. The Washington Office received 44,435 written requests for literature.

RECREATION RESOURCE PLANNING

Preparations to augment the Service's recreation resource planning program, as a part of Mission 66, were under way throughout the year. These additional cooperative services will begin with the new fiscal year. The Service, in cooperation with other Federal agencies and the States, will assist in formulating State, regional and national plans for the preservation, development, and use of outdoor recreation resources. Such comprehensive planning is based on recognition of the fact that public use of the nonurban recreation resources of the Nation is increasing tremendously with a rapidly growing population, a shorter workweek, and improving transportation facilities.

New Areas Established

The establishment of Virgin Islands National Park on December 1, 1956, has been noted elsewhere in this report. The Chimney Rock National Historic Site, near Baird, Nebr., was designated on August

9, 1956, and the Golden Spike National Historic Site in Utah on April 2, 1957. Both are in non-Federal ownership. The Booker T. Washington National Monument, Va., was established on June 18, 1957, upon acceptance of title.

New Areas Proposed

A bill was introduced, but not acted upon, to establish Dinosaur National Park in Colorado and Utah, to include substantially the lands in Dinosaur National Monument. Pursuant to legislation, the site of Fort Clatsop in Oregon, winter headquarters of the Lewis and Clark Expedition, was investigated. The Wheeler Peak region in the Snake Range of eastern Nevada was investigated jointly with officials of the Forest Service for possible National Park or Monument status; additional studies will be necessary.

At the request of and in cooperation with officials of the State of Maine, Service representatives participated in a reconnaissance survey of the Allagash River region in northern Maine.

The investigation and report to Congress on the advisability of establishing a national monument in Brooklyn, N. Y., in honor of the Maryland soldiers who fell during the Battle of Brooklyn on August 27, 1776, was completed in accordance with the act of August 3, 1955 (69 Stat. 445). It was recommended that the proposed national monument not be established. Other legislative proposals included bills to accord national park status to Petrified Forest National Monument, and the National Historical Park status to the 170 miles of the Chesapeake and Ohio Canal and certain adjoining lands, between Great Falls and Cumberland, Md., significant for their historic, scenic, and recreational values.

Area Abolishments

The Congress authorized abolishment of two national monuments judged to be lacking in national significance: Verendrye National Monument, turned over to North Dakota for historic site and other purposes, and Fossil Cycad, South Dakota. Disestablishment of the latter will take place in September 1957.

Boundary Adjustments

By secretarial order of March 22, 1957, about 11,000 acres were excluded from and 240 acres added to Badlands National Monument in South Dakota. The Mikveh Israel Cemetery in Philadelphia was authorized by act of Congress of August 6, 1956, as a unit of the Independence National Historical Park subject to the proviso that the

United States would not assume responsibility for its administration, care, and maintenance. Secretarial approval of proposed boundaries for Pea Ridge (Arkansas) and Horseshoe Bend (Alabama) National Military Parks made possible the start of land acquisition for donation to the United States. Pursuant to legislation, 165.80 acres were added to Pipestone National Monument, Minn., by secretarial order.

Bills were introduced to revise the boundaries of Everglades National Park, Florida; Grand Canyon National Park and Monument, Arizona; Sequoia and Kings Canyon National Parks, California; Lake Mead National Recreation Area, Arizona-Nevada; Fort Frederica National Monument, Georgia; Shiloh National Military Park, Tennessee; Whitman National Monument, Washington; and Cowpens National Battlefield Site, South Carolina. A bill before the Congress would authorize acquisition of property on the Michigan mainland for Isle Royale National Park headquarters.

Public hearings were held at Cedar City, Utah, on June 12, 1957, on withdrawals to add lands to Zion National Park and Capitol Reef and Arches National Monuments. General approval of the proposals was expressed.

Threats to the National Park System

A proposal to erect a sewage treatment plant on privately owned, vitally important historical land between the two segments of Chalmette National Historical Park, Louisiana, greatly affects the park's future.

The proposed River Bend Dam on the Potomac River above Great Falls, if constructed, would submerge some 35 miles of the Chesapeake and Ohio Canal and other areas of historic, scenic, and recreation value.

"Park Practice" Program

Appreciable momentum has been developed in the park practice program, started in 1956 as a joint effort of the National Conference on State Parks and the Service for exchanging ideas and experiences on park policies, practices, and solutions to problems. Subscribers now receive from the Conference at least 32 design sheets a year illustrating various types of park and recreation structures developed by local, State, and Federal agencies. They also receive Grist, an 8-page, illustrated, bimonthly information letter on operational procedures, time and money-saving devices and methods, and "tricks of the trade." The Conference and the Service have approved a prospectus for periodical issuance of guideline material dealing with all policy aspects of park administration. It is believed that this three-part program inspires closer cooperation among park agencies and reduces duplication of effort.

Advisory and Consultative Assistance

The Service assisted 47 of the States and the Territory of Alaska on various aspects of their park programs. Most encouraging was the enactment of legislation by Arizona and Utah creating for the first time State park agencies and authorizing establishment of comprehensive State park systems. The Service is happy to have been of some help in bringing about these forward steps. A significant accomplishment was the preparation, in collaboration with the Bureau of Land Management, of a master-plan report for the protection and development of the Junction Butte-Dead Horse Point recreation area in southern Utah which has exceptional scenic and educational value.

Disposal of Real Property

As required by law, the Service investigated and reported upon 26 applications submitted by State and local agencies to General Services Administration and other disposal agencies to acquire surplus Federal properties for park, recreation, and historic monument use. The Service also reported to the Bureau of Land Management on 30 applications by State and local agencies to lease or purchase public domain lands for park and recreation use.

State Park Statistics—1956

This publication, prepared from information gained through a questionnaire survey, reveals 2,100 State parks and related types of recreation areas, containing more than 5 million acres; expenditures of $28 million for land and capital improvements and $38 million for operation and maintenance; 6,048 year-round employees and 8,884 seasonal employees and more than 200 million visitors. Nine million of these were tent and trailer campers, double the number of 4 years ago.

Regional and Basinwide Surveys

Field work for the Missouri River Basin-Wide Recreation Survey is largely completed and the report is being drafted. Investigations of the recreation potentialities of the Delaware River Basin were continued by the Service as a part of the cooperative survey of the Delaware basin in which the Corps of Engineers, other Federal agencies, and four State agencies are participating.

The Recreation Subcommittee of the Columbia Basin Interagency Committee, which represents all Federal and State agencies of the basin dealing with recreation, published a report entitled "Recreation Areas and Facilities, Pacific Northwest Region." Continued cooperation and assistance were extended to the Columbia River Gorge Commission in connection with studies and advice relating to land acquisition for protection of the scenic character of the gorge. Recreation master plans for strategic areas of reclamation-withdrawn lands of the Lower Colorado River were prepared and transmitted to the Bureau of Reclamation for review.

Protests were made against proposals in the California Water Plan for reservoirs on the Middle Fork of the Tuolumne River and in the Wawona area of Yosemite National Park. The reservoir on the Middle Fork has been eliminated from the plan.

Special Recreation Surveys

Studies to determine the remaining opportunities to conserve natural areas along the Pacific coast and the Great Lakes shore were begun with donated funds. The studies will be similar in character and scope to the survey of the Atlantic and Gulf coasts completed in 1956.

Memorandums of agreement were negotiated and approved by States and their political subdivisions covering administration of eight reservoirs constructed by the Bureau of Reclamation. Recreation sections of reservoir management plans were furnished the Bureau for eight reservoirs.

The Service prepared for the Bureau of Reclamation 10 recreation reconnaissance reports, 5 planning reports, 10 letter reports, and 1 development plan, and for the Corps of Engineers 9 recreation reconnaissance reports. Thirty-nine applications for Federal Power Commission permits and licenses were reviewed.

National Survey of Outdoor Recreation Resources

A prospectus was drafted summarizing the major objectives of a study directed toward the formulation of a national plan to provide nonurban outdoor recreation areas and facilities at local, State, and Federal levels, and outlining suggested procedures. This nationwide study, to be started during the fiscal year 1958, is a major phase of Mission 66.

The survey of the recreation resources of northwestern California is nearing completion.

A master plan was prepared for the recreation development of lands of the Colorado Tribes Agency near Parker, Ariz. A recreation subcommittee has been organized by the Pacific Southwest Field Committee.

Reservoir Development and Management

Pursuant to a memorandum of understanding between the Region 4 office of the Bureau of Reclamation and the Region 3 office of the Service, recreation planning for authorized projects of the Upper Colorado River Storage project was initiated. To date, planning reports have been prepared for five reservoirs, including the Wahweap portion of the Glen Canyon Unit. Recreation planning of the Glen Canyon Reservoir area, one of the most scenic regions in the Southwest, is being directed toward its ultimate designation as a national recreation area.

Progress was made in negotiations for transfer of the Millerton Lake national recreation area to the State of California for administration.

OPERATIONS

The protection of scenic, scientific, and historic values in the national parks and monuments, assistance to and protection of the many millions of visitors who enjoyed them, the regulation of concessioner operations, the acquisition of much privately owned land, and the maintenance of physical plants—these comprise the major responsibilities of the Division of Operations.

During the past several years the division has gained considerably in experience and has improved its effectiveness. However, the additional responsibilities and the new or enlarged problems brought about by Mission 66 and the steadily mounting number of visitors using the national parks and monuments have resulted in a large increase in the workload handled in the Washington and Regional offices. In order to determine the most efficient way to meet this increased workload, a study of the organizational structure of the division was undertaken with particular attention to protection activities.

Park Rangers

The rapidly increasing volume of public use of the parks, with its attendant problems of protecting the visitor and the natural features, historic structures, and other resources, has placed a severe strain on the relatively small protection staffs. In addition to providing

FIGURE 31.—Mount Rainier National Park, Washington. Saddle party on the Wonderland Trail at Klapatche Lake; Mount Rainier rising high in the background.

necessary protection and prevention of detrimental activities, park rangers furnish many public services of importance, such as information and guidance, and exercise such controls as are needed for the safe, orderly, and beneficial use of the areas.

The long overdue improvement in the classification structure of park protection positions continued to receive attention; and favorable action was taken on a number of ranger position descriptions and reassignments.

Intensive training of protection personnel in the specialized activities in which they engage continues to receive attention.

Forest Fire Control

Despite several very critical fire hazard periods and steadily increasing public use, the total number of man-caused forest, brush, and grass fires, in the National Park System continues to show a steady decline. Also, the rising trend of camper-caused fires noted in recent years was reversed and the acreage burned over by all fires was well below average. In contrast, lightning caused more fires than during any previous year, so that the total number of fires was greater than normal.

Forest Pests

Forest pest control projects in the national parks receive technical guidance from the Division of Forest Pest Control of the Forest Service, United States Department of Agriculture, and this direction has been most helpful in protecting park vegetation.

The program for protection of the picturesque subalpine five-needle pines in western parks from white pine blister rust is well developed and control work is advancing on schedule. These trees, not now being protected generally by any other agency, will provide valuable samples for future observation. The control of dwarf mistletoe on ponderosa pine in the forests of Grand Canyon was extended to include a fine stand of pine, along the route of the new East Rim Road. Intensive research has been continued to find a means of controlling the destructive lodgepole needleminer, which threatens to destroy pines on 550,000 acres within Yosemite National Park. The epidemic of southern pine beetle in Great Smoky Mountains National Park is being steadily reduced under an aggressive control program.

An unusual amount of storm damage to shade trees in areas generally located east of the Mississippi River, including cemeteries, increased the need for special arboricultural work.

Maintenance

Because of continued difficulty in recruiting maintenance personnel, particularly engineers, a study of each position was made throughout the Service to assure proper distribution and maximum use of the professional skills required to maintain physical plants. A new system for collecting workload data used to determine actual maintenance requirements and to complement the programing system initiated last year was put into operation. This information provides comparison, on a unit-cost basis, of maintenance operations throughout the Service, permitting management to determine more clearly overall needs and efficiency.

Public demand for the earlier opening of park roads was met this spring in several areas by starting snow removal operations several weeks earlier than had been undertaken in the past.

Travel to the Parks

Public use of the areas administered by the National Park Service broke sharply upward in 1956. The increase was at a rate double that of the 5 percent rise in 1955, and the most violent upsurge since mid-1952. Visits in 1956 totaled 54,923,000, up 10 percent from 1955. It now seems likely that public use in 1958 will be three times that of 1946.

Travel Survey

Publication of the final report on the Great Smoky Mountains National Park travel survey is expected momentarily. This survey, conducted by the State Highway Departments of North Carolina and Tennessee in cooperation with the National Park Service, will discuss the travel characteristics associated with that Park in great detail.

Control Schedules Revised

Mission 66 control schedules were revised to allow for adjustments resulting from approval of park development prospectuses; the addition of new areas to the system; the inclusion in the Mission 66 program of development costs for which separate authorizations had been anticipated when the original schedules were prepared; and provision for increases in construction costs.

New Procedure for Construction Proposals

A comprehensive check list, prepared by the Eastern Office of Design and Construction, was issued to insure that consideration is given to all of the components required for various construction projects. Use of the list will result in the submission of more complete data from which to prepare construction drawings and cost estimates. Construction cost indices are issued periodically, so that estimates are always based on current costs.

Delegation of additional programing functions to the regional offices has materially reduced the flow to the Washington Office of correspondence concerned with final decisions on projects making up the programs.

Flexibility in Reprograming Authorized

The Appropriations Committees while considering the 1958 budget, recognized a need for greater flexibility in the construction programs of the Service. The Report on the Interior and Related Agencies

Appropriations Bill by the House Committee on Appropriations "* * * authorized the Director to make such adjustments in the construction program as become necessary due to unforseen circumstances, provided they are made within the fiscal year fund limitation and are within the overall 10-year program." The Senate Committee on Appropriations took no exception to the statement in the House Report.

Use of Future-Year Contract Authorization

Roads and trails and parkways construction was facilitated greatly through use of authority provided by the Federal-Aid Highway Act of 1956 to incur contract obligations in 1957 for projects programed for the 1958 fiscal year.

Land Acquisition

During the year $1,300,000 was made available for land acquisition, of which $400,000 was donated. Some 52,500 acres of inholdings were acquired by purchase, donation, or exchange.

Donations included some 220 acres from the Commonwealth of Virginia and 1,050 acres from the State of North Carolina for Blue Ridge Parkway; 1,025 acres from North Carolina for Cape Hatteras National Seashore; 10,530 acres from the Territory of Hawaii for Hawaii National Park; and 225 acres from the State of Tennessee for the Foothills Parkway. Virgin Islands National Park was established on December 1, 1956, when the Secretary accepted donations of 420 acres from Caneel Bay Plantation, Inc., and 4,665 acres from Jackson Hole Preserve, Inc.

Completed purchases and approved options cover some 7,500 acres of land and improvements in Big Bend, Glacier, Grand Canyon, Lassen Volcanic, Grand Teton, Great Smoky Mountains, Rocky Mountain and Yosemite National Parks; Badlands, Colorado, Joshua Tree, Organ Pipe Cactus, Petrified Forest, Saguaro and Sitka National Monuments; Gettysburg, Fredericksburg, and Guilford Courthouse National Military Parks; Colonial and Independence National Historical Parks; Fort Caroline National Memorial; and Theodore Roosevelt National Memorial Park. Awaiting acceptance at the end of the year were some 75 options totaling about $585,000 and covering approximately 4,400 acres of improved and unimproved land.

Special Uses of Park Lands

Most special use permits issued during the past year continued to be for agricultural use of small parcels of land to maintain historical and rural scenes, for access to private lands from park roads, and for utility lines. The number of requests for information on mining in the national parks and monuments and for vacation cabin sites in national recreation areas remained about the same as in previous years.

Water Resources and Rights

Progress in investigation of water resources and acquisition and protection of water rights continued, despite a shortage of investigation funds. With the $31,182 available, only eight ground-water investigations were possible. Four State water-right licenses and one permit were granted. One licensed claim was surrendered when commercial power became available. Four new applications and two petitions for amendment of rights were filed. Four established rights were acquired and two more are in progress. Twenty time extensions were obtained, 2 conflicting claims protested, and 14 progress reports filed. Voluminous requested records were compiled to support claims to Lower Colorado River water in the Federal Intervention in *Arizona* v. *California* before the Supreme Court.

Figure 32.—Rocky Mountain National Park, Colo. View of Longs Peak from Rock Cut area on Trail Ridge road.

Concession Authorizations

Ten concession contracts and 24 concession permits were negotiated during the 1957 fiscal year. In connection with new contracts, construction programs were negotiated for Glacier National Park with the Lake McDonald Boat Co., and for Lake Mead National Recreation Area with Lake Mohave Resort, Inc. In the latter case, the concessioner agreed to expend $150,000 during the first two years of the contract and has indicated a willingness to provide additional improvements as needed during the remainder of the contract period, with a total investment of approximately $500,000.

Prospectuses

Five prospectuses were issued, soliciting offers for the operation of concession facilities at Olympic, Big Bend, and Mount Rainier (Ohanapecosh) National Parks, the Virginia portion of the Blue Ridge Parkway, and Coulee Dam National Recreation Area. No contracts have been negotiated as a result of these prospectuses, although offers have been received in response to the Blue Ridge prospectus. Offers in response to the Mount Rainier prospectus are not due until August 1, 1957.

Concessioners' Improvements

In Lassen Volcanic National Park, the Lassen National Park Co. completed a new store building and housekeeping cottages, costing $165,000. These were dedicated on August 25, 1956. The Everglades Park Co. has completed a marine building and gasoline service station in Everglades National Park at a cost of $54,000 and plans are underway for the construction of overnight facilities, to be in operation by December 1. The Yellowstone Park Co.'s Canyon Village development, consisting of lodge facilities costing $2,822,175, was opened on July 1, 1956. The company also constructed an office building at Old Faithful and did other renovation and improvement work costing $284,322. Hamilton Stores, Inc., will have ready for public use in July a store and gasoline service station at Canyon Village constructed at a cost of $995,000. Through the efforts of the Mount Rushmore National Memorial Society of the Black Hills, a new concessions building has been constructed at Mount Rushmore National Memorial, costing approximately $494,388. The Grand Teton Lodge Co. development at Colter Bay in Grand Teton National Park will be available during the 1957 season. It consists of cabins, cafeteria, store, etc., constructed at a cost of about $2,000,000. Concessioners at Big Bend, Crater Lake, Rocky Mountain, Sequoia, Shenandoah, and Yosemite

National Parks and the Lake Mead National Recreation Area have also made improvements and completed building programs during the year.

General

Donald T. Knutson of Minneapolis, Minn., assumed the management of the Glacier Park Co. in Glacier National Park on January 1, 1957, under a management contract covering a 3-year period ending December 31, 1959. The contract may be extended for an additional 2-year period upon agreement between the parties.

ADMINISTRATION

Appropriations

The Service's financial position was greatly improved through the increased appropriations for the 1957 fiscal year, the first year of the Mission 66 program. While more adequate protection of park features and facilities, improved service to the public, and a higher standard of maintenance of physical facilities were made possible by the increases in the operating appropriations, the most significant improvement was the substantial increase in construction funds, making possible for the first time since World War II, a program, geared to need, for the construction of buildings, utilities, and other facilities. A comparison of the 1957 appropriations with those for 1956 is as follows:

Appropriation item	1956 fiscal year	1957 fiscal year	Increase (+) or decrease (—)
Management and protection	$10, 443, 000	$11, 562, 000	+$1, 119, 000
Maintenance and rehabilitation	9, 094, 000	10, 158, 000	+1, 064, 000
General administrative expenses	1, 250, 000	1, 250, 000	------------
Construction	8, 425, 000	15, 250, 000	+6, 825, 000
Construction (liquidation of contract authority)	19, 654, 300	29, 800, 000	+10, 145, 700
Total cash appropriations	48, 866, 300	68, 020, 000	+19, 153, 700

Increase in Workload

Prosecution of the Service's expanded programs brought a substantial increase in the budget and finance workloads throughout the Service. Through organizational and procedural changes the additional workload was met in the Washington office without an increase in staff, and with very modest additional staffing in the field.

Program for Improvement in Financial Management

During the year the Service's program for improvement in financial management, which has been in progress for the past 4 years, was integrated with the governmentwide program as prescribed by the Bureau of the Budget in Bulletin No. 57–5, dated October 10, 1956. One of the major requirements was met as of December 31, 1956, when installation of the Service's new accounting system and financial reporting procedures in all of the field finance offices was completed. The Service's plan calls for completion of its financial improvement program with the preparation of a cost-based budget for the 1960 fiscal year. Financial management was further improved by reducing the number of field finance offices from 28 to 24. During the year such offices at Carlsbad Caverns, Crater Lake and Mammoth Cave National Parks, and at the Southwestern National Monuments Headquarters were closed and their functions transferred to the regional offices having jurisdiction over them.

Establishment of Imprest Fund Cashiers

Substantial improvement in the Service's procurement procedures was achieved during the year through the designation of imprest fund cashiers in 35 areas and offices. Under the new procedures many of the individual small purchases formerly handled on a charge basis are now paid for in cash, thus reducing clerical work and improving relations with business concerns from which the small purchases are made.

Personnel Work Increases

The work force of the Service, under the stimulus provided by the Mission 66 program, has continued throughout the year to enjoy a steady but conservative growth to meet growing responsibilities. In a growing organization, the volume of personnel work naturally increases and, as it increases, it is imperative that policies be suitably revised and that procedures be changed to meet new situations. The Branch of Personnel has been taking steps throughout the year to convert more fully to a staff advisory operation and to reduce materially the volume of cases handled on an individual basis.

Employee Development

To meet the challenges presented by the needs of a growing organization and by the difficulties of recruitment and retention which have arisen as a result of occupational shortages in several fields, every effort has been made to expand and intensify employee training and development. A major move in this direction was the use of a questionnaire to gather full and detailed information concerning the character and effectiveness of training carried on throughout the Service in our field establishments. In conjuction with this survey, four strong "task forces" were established to develop concrete suggestions and recommendations for a comprehensive program of employee development. The task forces devoted their attention to the following areas of employee development: clerical and secretarial, professional and technical, trades and crafts, and supervisory and executive training. The Service's training officer was doing intensive work, at year's end, on the very valuable material and recommendations which were produced by these task forces.

Employee Training

Another major development in the field of training was the crystallization of plans for establishing a training center at a field location for the intensive training of new employees in the fields of protection and interpretation. Plans and arrangements for the new training center, in many respects a unique development in the Federal Government, were carried out so effectively that, at year's end, its establishment and operation at Yosemite National Park in fiscal year 1958 was assured.

The Service also conducted two of its general administration training courses this year, one in the Region 5 office, Philadelphia, and the other in the Region 2 office, Omaha. Both courses were attended by more than 25 picked fieldmen who received the benefit of 2 weeks of intensive instruction from the Assistant Director (Administration) and key staff members of the Washington and regional offices.

Position Classification

This was the first year in which the regional directors exercised classification authority; the results of limited delegation (through grade GS–7) were satisfactory. The caseload of classification actions in the Washington Office was reduced by this delegation to an extent which made it possible to devote a considerable amount of time to a major survey project—the complete review of key positions in all five regional offices. This review is still under way but is at least two-thirds complete. The other major project was the preparation of new class specifications for the park ranger series, to replace those adopted in 1948. At the year's end, the Civil Service Commission rescinded the old park ranger standards, pending completion of action on the proposed revision.

Employee Placement and Employee Relations

In the second half of the year a good start toward development of an employee relations program and a step-up of activity in the field of incentive awards was made when a new position of employee relations officer was established and filled.

Important Changes

The personnel changes of outstanding interest were the following: Lemuel A. Garrison became superintendent of Yellowstone National Park, succeeding Edmund B. Rogers, who had held that position for more than 20 years. Mr. Garrison was succeeded by John M. Davis in the important Washington Office position of chief of conservation and protection. With the move of Mr. Davis to the Washington Office, the position and office of general superintendent, Southwestern National Monuments, were abolished. The former training officer of the Service, Frank Kowski, became the first supervisor of the new training center, and was succeeded in the position of training officer by Julius E. Eitington, who, in turn, was succeeded in the position of chief, classification section, by Geneva Pillars.

Three important new superintendencies were filled for the first time. Melvin J. Weig was promoted to the position of superintendent, Edison Laboratory National Monument; Harold A. Hubler was promoted to the position of superintendent, Virgin Islands National Park and San Juan and Virgin Islands National Historic Sites; and Glen T. Bean was promoted to the position of superintendent, Bryce Canyon National Park.

Administrative Manual Revision

The revision of the National Park Service Administrative Manual, a management improvement project, has progressed well during the year. The existing volumes of the Manual are being revised in a new format and are to be reduced to five volumes. Obsolete and inappropriate material is being deleted and new or revised material incorporated to provide an effective working tool for officials and employees in the field. Of the 5-volume revision, 1 volume has been completed, 6 parts of other volumes have been published, and 25 parts are in draft form.

Plans have been approved for abolishment of the Branch of Office Services as such, and for consolidation of its functions with others in a new Branch of Property and Records Management.

Visitor Accident Fatalities

Fifty visitors died as the result of accidents in the calendar year 1956. Twenty-two resulted from motor vehicles and 20 from drowning; 30 of the 50 occurred in the age group 25 or under.

With 54,923,443 visitors the fatality rate was 0.91 per million visitors for 1956; in 1955 the rate was 1.08.

While the number of motor vehicle fatalities nationally increased sharply in the calendar year 1956, there was no increase in visitor motor vehicle fatalities in areas administered by the Service.

Employee Safety

The Service is continuing its cooperation with the Department in a program aimed at the reduction in employee injuries. Considerable work has been done in drafting a revised health and safety program, including plans for an enlarged staff to make the program effective.

NATIONAL CAPITAL PARKS

Administration

A survey of National Capital Parks was completed by the survey team appointed by the Secretary of the Interior and its recommendations are now being carried out in accordance with the instructions of the Secretary.

Physical Improvements

Significant physical improvements included the beginning of construction work for the George Washington Memorial Parkway from Spout Run to Langley, Va.; reconstruction of a portion of the Rock Creek and Potomac Parkway; new lighting for the Thomas Jefferson statue; new heating and cooling system at the Jefferson Memorial; painting the exterior of the Executive Mansion and Executive Offices; completion of Milkhouse Ford Bridge and Kalmia Bridge in Rock Creek Park; rehabilitation of Klingle Mansion for the new Rock Creek Nature Center; restoration of the Paw-Paw tunnel on the Chesapeake and Ohio Canal; and completion of landscape plantings for the Columbia Island Marina, the Great Falls parking area, East Capital Street Bridge approaches and Rock Creek parking lots at Beach Drive and Military Road.

Special Events

Some 256 public events were held, including such major civic undertakings as the National Independence Day Celebration, the President's Cup Regatta, the Christmas Pageant of Peace, and the Cherry Blossom Festival.

Visitor Services

Historical and natural history visitor services included school assembly talks; organized museum and nature center visits; and outdoor program of conducted walks, tours, and evening programs; and service band and symphony concerts at the Watergate.

Museum Acquisitions

Valuable acquisitions included engravings of the Lincoln family and the Battle of Gettysburg, given by Mrs. Dwight D. Eisenhower; and six pieces of the original parlor furniture for the Custis-Lee Mansion, on indefinite loan from Mrs. George Bolling Lee.

Research and Planning

A general development plan for Fort Washington was completed; development plans were completed for the Columbia Island Marina clubhouse, Old Stone House, and Chevy Chase Circle; development studies were made for Washington Monument Grounds; park operations building, water sports center, and the national monument on the Nevius tract.

Protection

The United States Park Police received many commendations, including a letter of praise from President Eisenhower. The Park Police cooperated with the Department of State in demonstrating police methods and techniques to visiting foreign police officials.

Land Acquisitions

Some 15 parcels of land were acquired and recorded in the land records, the major acquisition being for the George Washington Memorial Parkway in Arlington County, Virginia.

DIVISION OF AUDITS

In spite of the difficulty of recruiting auditors qualified to participate in our audit program at the grade levels authorized, the Division of Audits has made excellent progress. Major reports completed during the year cover the following Service and concession operations: Lincoln Museum and the House Where Lincoln Died, Washington, D. C.; Lehman Caves National Monument, Nevada; Statue of Liberty National Monument, New York; Mammoth Cave National Park, Kentucky; Circle Line-Statue of Liberty Ferry, Inc., Statue of Liberty National Monument, New York; and National Park Concessions, Inc., with operations on the Blue Ridge Parkway in North Carolina and Virginia and at Mammoth Cave, Big Bend, Isle Royale and Olympic National Parks in Kentucky, Texas, Michigan and Washington, respectively. The audit program and reports are designed to provide management with an objective review and appraisal of all operations on a systematic and recurring basis.

OFFICE OF TERRITORIES

Anthony T. Lausi, *Director*

DURING the fiscal year the Office of Territories has continued its historic mission of promoting political freedom, encouraging economic development, and providing essential governmental service in Alaska and in the islands of the Caribbean and the Pacific that comprise the Territories of the United States.

In two of these Territorial areas, Alaska and Hawaii, the progress of self-government has so far advanced that few political services need be provided by the Department of the Interior. That these two Territories would ultimately become States has been implicit in their relationships with the Federal Government since their establishment as Territories. That they should achieve statehood now is the firm policy of the present administration.

During the fiscal year considerable progress toward making these two Territories the 49th and 50th States of the Union has been made. President Eisenhower has proposed statehood for Alaska with national defense interests safeguarded through the power to withdraw certain areas in which the Federal Government will have jurisdiction for defense purposes. Most of Alaska, however, and all but a tiny fraction of its population, would be included within the new State. After extensive hearings in March 1957 the House Committee on Interior and Insular Affairs of the 85th Congress overwhelmingly approved an Alaska statehood bill. The next fiscal year may see Alaskan statehood finally achieved.

The administration is equally determined that Hawaii shall see its statehood aspirations fulfilled at an early date.

The Department is proud of the fact that the fiscal year brought outstanding "firsts" in high Territorial appointments. In Alaska, for the first time, an Alaska-born citizen was named governor, while in American Samoa, and also for the first time, a native-born Samoan succeeded to the governorship. It is likewise an indication of forward-looking Department policies that a career employee has become High Commissioner of the Trust Territory of the Pacific Islands.

Two major Office of Territories functions in Alaska were discontinued during the fiscal year. In September 1956, the road-building and maintenance functions of the Alaska Road Commission, which had been a Department of Interior responsibility for many years, was transferred to the Bureau of Public Roads of the Department of Commerce. In February 1957, Alaska's mental health program was transferred from the Department to the Territorial government.

In all the Territories the Department continued to emphasize the importance of efficient and economical administration of the Department's Territorial functions. This policy, combined with the encouragement of sound economic development, has been thoroughly justified by events.

In the Virgin Islands it has been unnecessary, for the first time in years, to borrow money to finance current operations. The Virgin Islands Corporation has had one of its most successful years.

American Samoa has made noteworthy economic progress. Pago Pago has seen a sharp increase in its port operations. The fish cannery, sponsored by the Department and the Samoan government, as a private enterprise venture, has continued to be an unqualified success. The fiscal affairs of American Samoa are in good order.

In the Trust Territory efficient governmental administration has contributed greatly to the progress of the Islands. Local trading companies have received governmental guidance and government loans where necessary. Copra operations have been improved and the copra stabilization fund has insured to Micronesians a steady income from copra in spite of declining copra prices. Fishery operations and new agricultural activities are being promoted.

The presence of the Military on Guam is the basis of a continued prosperity which places that Island in an extremely favorable economic position. The Government of Guam has worked in close cooperation with military authorities in solving Island problems.

Boom conditions continue in Alaska. The successful pulp operation at Ketchikan has encouraged other similar use of southwestern Alaska's great forest resources. Another mill at Sitka seems certain and there are prospects for a pulp operation at Juneau. Extensive private drilling for oil is at last producing results and, as the fiscal year ended, there was at least the possibility of a major oil strike on the Kenai Peninsula.

Government services for which the Department of Interior is responsible continued to meet the twin standards of high quality and reasonable cost. The Alaska Railroad increased its commercial serv-

Figure 33.—A native celebration, Samoa.

ices and operated without congressional appropriations in spite of the loss of a large and profitable petroleum movement to the military Haines-Fairbanks pipeline. The Alaska public works program sponsored additional civic improvements which, over the past several years, have greatly increased the amenities of living in Alaskan towns and cities.

In American Samoa and in the Trust Territory, federally administered health, education, and public works programs have progressed to higher standards with ever greater participation on the part of Samoan and Micronesian personnel.

In all these Territorial activities the Department has been thoroughly aware of its international responsibilities. In many respects the Territories are laboratories of democracy. It is important to the position of the United States in world affairs that the world should know that our experiments in the application of democratic principles to varied peoples in far places have proved increasingly successful.

ALASKA

Statehood Progress

Alaska made substantial progress toward statehood during the 1st session of the 85th Congress.

In his budget message President Eisenhower recommended "that, subject to area limitations and other safeguards for the conduct of defense activities so vitally necessary to our national security, statehood should also be conferred on Alaska." On behalf of this administration policy the Secretary of the Interior urged the enactment of statehood legislation which would also provide adequate protection for national defense interests in northern and western Alaska.

The administration's defense proposal would authorize the President to create one or more special national defense areas over which the Federal Government would exercise exclusive jurisdiction. Legislative, executive, and judicial powers over such national defense areas would be vested in the United States and the laws of Alaska would be adopted as Federal laws. The State of Alaska, however, would retain the power to prescribe voting requirements and procedures, and the right to enforce its voting laws within the boundaries of the lands withdrawn for defense purposes.

Alaskans recognize the importance of meeting national defense requirements and virtually no objections have been raised in the Territory to the administration's proposal. The authority to be conferred upon the President, with respect to only a part of Alaska, is similar to that previously conferred upon the United States by 25 States.

The Committees on Interior and Insular Affairs of the 85th Congress have held extensive and thorough hearings on the subject of Alaskan statehood. Through 10 days of public hearings during March 1957, opportunity was given proponents and opponents to make known their views to the House Committee. By a vote of 24 to 6 the full Committee reported the bill favorably.

H. R. 7999, a substitute bill which incorporated most of the administration's recommendations, was introduced and reported favorably by the House Committee late in June. This bill provides for the approval of the draft constitution ratified by the Alaskan electorate on April 24, 1956, and substantially hastens the day when Alaska will join the Union as a State.

Alaska-Born Governor Appointed

In Juneau, on June 8, 1957, the first Alaska-born Governor of Alaska took his oath of office. Michael A. Stepovich of Fairbanks, who is also the youngest man ever to become Governor of the Territory, succeeded B. Frank Heintzleman, who had served from April 10, 1953, to January 3, 1957. Waino E. Hendrickson of Juneau was reappointed by the President for a second 4-year term as Secretary of Alaska.

Developments in Free Enterprise

The rate of economic activity in Alaska was maintained at a high level during the fiscal year. Population continued to grow and both westward and southeastern Alaska have shared in the economic progress that has been made.

An increase in private enterprise activities in Alaska is an encouraging portent for the future. In southeastern Alaska the success of the $56 million pulp mill at Ketchikan has been followed by other large programs for utilizing Alaska's immense forest resources. A new pulp mill at Sitka seems assured and a mill at Juneau is in prospect.

Interest in oil discovery continued high in spite of inconclusive results from current drilling. Shortly after the close of the fiscal year the Richfield Corp. brought in a well on the Kenai Peninsula. The resulting boom in oil leases saw nearly three-quarters of a million acres filed on in a single day. There is no doubt that a confirmed oil strike in Alaska will mean a tremendous stimulus to the Territory's economic growth.

Legislative Session

The 23d Territorial Legislature convened on January 28, 1957, for its regular biennial session. High among its accomplishments were the enactment of modern commitment and hospitalization provisions for the Territory's mentally ill, the passage of tax incentive legislation, and the reorganization of several of the Territory's executive agencies. The Legislature also passed a measure creating an Alaska Fish and Game Department and an Alaska Fish and Game Commission.

The enactment by the 84th Congress of the Alaska Mental Health Enabling Act, Public Law 830, was a significant step forward in the Department's policy of assisting the Territories to assume the maximum possible responsibility for their own affairs. Responsibility for the commitment and care of the Alaskan mentally ill, exercised by the Federal Government since 1900, was transferred to the Territory in accordance with the act on February 23, 1957. At the time of the transfer of responsibility, 368 patients were under care.

Figure 34.—Mount McKinley National Park, Alaska. "Denali" as seen from the highway.

Under previously existing Federal statutes, patients were cared for in a private hospital in Portland, Oreg., under contracts with the Secretary of the Interior. Hospitalization facilities in the Territory were nonexistent. Public Law 830 authorizes the full exercise of authority by the Territory for commitment and hospitalization of the mentally ill and provides for grants totaling $12,500,000 for construction purposes and for carrying out a mental health program. The act also provides for a land grant of 1 million acres to assist Alaska in meeting these responsibilities. The way was thus cleared for the enactment of a modern mental health program by the Territorial Legislature.

Revision of Territorial land laws will promote better management of lands including those granted under the Mental Health Enabling Act and other land measures pending before the 85th Congress.

Enactment of the legislation creating the Fish and Game Department was marked by controversy. This legislation resulted, however, from a desire of Alaskans to participate more actively in the management and development of their natural resources. Responsibility for Alaska's fish and game is vested in the Federal Government. While this responsibility is unchanged by the Territorial statute, the newly created Department is "to assist in the protection, research, restoration, propagation, and increase of fish and game of the Territory of Alaska."

Alaska Road Commission Transferred to Commerce

On September 16, 1956, the Alaska Road Commission, under the jurisdiction of the Department of the Interior since 1932, was transferred to the Department of Commerce in accordance with the provisions of the Federal Aid Highway Act of 1956, Public Law 627. The Commission, originally created in 1905, had built more than 3,500 miles of roads interconnecting the Territory's principal cities and military installations and serving agriculture, mining and industrial areas. Subsequent to the transfer, the Commission was reorganized as Region 10 of the Bureau of Public Roads.

Rail and Highway Commission

In early fiscal year 1957 the Congress enacted legislation creating a commission to make thorough and complete studies of the economic and military advantages and benefits of additional highway and rail routes between the United States and Alaska and to make feasibility studies of possible feeder routes from coastal ports. The final report and recommendations of the Commission are to be submitted to the Congress by August 1, 1958.

Amended by Public Law 85–16 to increase the membership to 13, Public Law 884 was implemented in June 1957 by the appointment of the 13 Commissioners by the President. The Office of Territories promptly undertook arrangements for the first meeting of the Commission while a request was initiated for $75,000 to be appropriated to the Commission to enable it to carry out its duties. The first meeting was scheduled for July 1957.

The Alaska Railroad

Despite continued losses in oil revenue during fiscal year 1957 to the military, Haines-Fairbanks pipeline, many physical improvements were made by The Alaska Railroad to increase operational efficiency and to develop new traffic. No congressional appropriations were requested nor are any anticipated for the immediate future.

A program of administrative economies, coupled with physical improvements to the Railroad property, was instituted by the general managership which was changed in August, 1956. The administration continued the policy of selecting qualified men from the ranks of railroad management in the United States to direct The Alaska Railroad. This policy has resulted in improved service, increase in the quantity and quality of the physical assets of the Railroad, and decreased operating expenses. It should be continued.

To replace traffic lost through diversion of bulk petroleum products to the military pipeline, the Railroad further developed its trailer-on-flat-car and unit rail box service. Two major shippers, Garrison Fast Freight Lines and Alaska Freight Lines, are utilizing these "piggyback" services the year around because of traffic arrangements with the Railroad. Loading ramps have been constructed at Seward, Anchorage, and Fairbanks.

Sixty-five new unit rail boxes, 25 equipped with temperature control devices, were added to the 9 purchased in fiscal year 1956. The Railroad took delivery on 50 70-foot flat cars for unit rail box service and other commodity loading.

Construction by General American Transportation Co. has now started on the building of 50 roller-bearing hopper cars.

Outstanding among physical improvements was the completion of the first berth and transit shed of the Marine Terminal, Seward. Because of expected increasing efficiency in cargo handling, the Railroad called for bids on a new longshore contract at the Seward terminal. It is estimated that annual savings of $300,000 will accrue to the Railroad as a result.

To improve Railroad communications and assist the Army-operated Alaska Communication Services, a contract was let to build a microwave system in an area where snowslides frequently take out wire circuits.

The Anchorage International Airport spur was completed in May to serve two major oil companies, the Civil Aeronautics Authority and the United States Post Office. It is anticipated that the spur will open a considerable industrial area.

An inventory of all nonexpendable property of the Railroad was started and reductions in surplus items carried in Railroad stores are being continued. A reclamation yard for the reclaiming of usable parts and the separation of scrap is now being developed in the Anchorage rail yard.

Continued work, in rehabilitating roadway, track and equipment, started in previous years is progressing satisfactorily.

A refinement of the Railroad's accounting and record systems is being completed. A considerable savings in personnel expense will accrue as a result of the increased use of I. B. M. techniques, extending to property and equipment records and the compilation of statistics. Increased emphasis has been placed also on internal auditing as a means of assuring compliance with regulations, and evaluating practices and procedures.

Public Works Program

In 1949, by Public Law 264, the 81st Congress authorized a $70 million program of public works in Alaska to foster economic and social development through provision of facilities for community life. This 5-year act was later extended by Congress to June 30, 1959. Under this program the Federal Government, upon application by a public body, such as the Territory, a city, a school or utility district, finances the entire cost of construction of approved projects and, upon their completion, transfers them to the public bodies for whom they are built at prices that will return to the Treasury of the United States not less than 50 percent of the total cost.

Through June 30, 1957, congressional appropriations totaling $58,676,200 have become available. Allotments have been made in the amount of $58,502,000 to 139 projects, including $328,000 to 18 units for emergency relief, 52 schools, 6 hospitals, 8 municipal buildings, 36 sewer and water projects, and 19 other projects, including streets and utilities. Of these, 112 projects valued at $41,429,267 are complete. Another 6 projects valued at $6,258,000 are substantially complete, and 16 projects with an estimated value of $9,512,150 are under construction. Another 5 projects, estimated to cost $1,303,450 are in the planning stage and are expected to be under construction during the 1957 construction season.

This has been a popular program in Alaska and Alaskan citizens have been more than willing to authorize the necessary taxes to repay their share of its cost. While there remains to be appropriated only $11,323,800 of the originally authorized $70 million, there are pending at the present time applications for projects estimated to cost approximately $41,170,000. The appropriation for fiscal 1958 is $6 million.

HAWAII

Hawaii faced the challenge and the problems of a rapidly expanding economy as nearly every index of economic growth continued to show strength during 1956–57.

Reflecting the economic trend, tax collections reached record levels. Collections of Territorial general fund revenues amounted to $101,456,377 during the 1955–57 biennium, exceeding the yields of the previous biennium under the same tax structure by more than $10 million.

Tourism reached record proportions with every expectation of still greater growth ahead. Continued national prosperity and an aggressive promotional campaign resulted in approximately 150,000 visitors spending 2 or more days in Hawaii during the fiscal year. Visitor expenditures were in the neighborhood of $73 million. New Waikiki beach hotels give striking evidence of this expansion.

Military activity and expenditures, from which the Hawaiian economy derives a substantial income, continued to increase. On July 1, 1957, Hawaii became the command headquarters of all United States Armed Forces in the Pacific and the Far East.

Production in the basic agricultural industries of sugar and pineapple growing continued to show improvement.

Industrial-commercial construction showed a sharp upturn during the last 6 months of the fiscal year. Construction of dwellings also increased. However, a housing shortage exists which has been aggravated by the influx of additional military personnel. Unemployment declined during the year while both the size of the labor force and the number employed showed an increase.

The increasing pace of economic activity has been accompanied by a growing demand for governmental services. The pressure for more spending to meet these needs, especially in education, has been partially offset by economy measures adopted by other Territorial agencies. Public works of major importance, particularly in highway construction, and water supply improvement, were undertaken. New farm and homesteading acreage have been opened up under the auspices of the Hawaiian Irrigation Authority. The long planned Molokai irrigation project, when completed, will provide water to irrigate about 14,000 acres, nearly all of it pineapple land. Other irrigation projects are under consideration.

Enrollment in the public schools, which has increased by an average of 5,000 pupils annually, reached an all-time high of nearly 125,000 as of December 1956. The problem of providing adequate classrooms remains acute.

The challenge of creating new jobs continued to be a major problem. Economic planning is receiving concentrated attention, with emphasis on the development of new export industries and local production to replace as many imported items as practicable.

Hawaii continues to be one of the healthiest places in the world, according to its public health record.

TRUST TERRITORY OF THE PACIFIC ISLANDS

During the 12 months under review, the administration of the Trust Territory continued to advance its many programs for assisting the Micronesian people to attain higher living standards and a greater degree of political and economic self-sufficiency.

Growth in Self Government

The establishment of basic plans for the incorporation of municipalities, and the completion of the chartering of district congresses, constituted the major effort of the year in advancing the art of government. The granting of formal charters to congresses and municipalities is now under way. During the year a conference at Guam of Micronesian leaders, chosen by local district congresses or similar groups, contributed to a broader understanding of the political problems of the Islands. Another conference at Trust Territory headquarters brought together the Micronesian officials of the nine chartered trading companies. These companies were assisted in putting their affairs on a sound financial basis by a Trust Territory staff auditor and two of them were granted new loans during the year. All stock in the major trading companies is Micronesian-owned, and distribution is widespread.

A tax survey of the Territory was made and the resulting recommendations were studied to determine which revisions in the Territory's tax structure would be advisable.

Other developments included a revision in the allotment structure of the government to permit the preparation of cost-based budgets. Under the direction of the chief justice a judiciary conference was held at Guam with Micronesian judiciary representatives present. The Deputy High Commissioner was advanced to the post of High Commissioner and a new Deputy High Commissioner was appointed. Two top district administrative positions, which were formerly filled by American staff members, were assumed by Micronesians.

Economic Efforts Intensified

Sales of copra, the chief commodity of the Trust Territory, increased slightly over the preceding year. Almost 13,000 tons were sold for a revenue return of approximately $1,400,000 to the Micronesians. In a declining world market copra income to islanders was maintained at a steady level through the copra stabilization fund.

Improvement in agricultural practices, particularly with respect to coconuts, was achieved. A specialist in coconut operations carried on extensive work among the islands and thousands of new plantings were made. An improved type of dryer for coconut meat was introduced which resulted in a spectacular improvement in copra quality where put to use.

Similar activity was carried on with respect to trochus shells. The marine biologist made a survey of trochus habits and availability in Trust Territory waters, and offered recommendations for conservation. Although trochus shell volume was down from the preceding years, the higher market price produced a return of $388,888 which is $38,000 more than during the previous year. Extensive research was performed on a major project to begin in July 1957 for the planting of live trochus in suitable locations among the islands as nucleii for future harvestings.

Further development in both agriculture and fisheries is expected to come as a result of the return of Micronesian students from abroad. Two special programs were arranged for trainees in cocoa and fishing. In all districts, staff agriculturists are conducting extension services as well as maintaining agricultural centers and field nurseries. An appreciable increase in the production of vegetable produce has resulted. The upgrading of livestock is being accomplished through the introduction of purebred animals.

Education and Public Health

Emphasis in education is being placed on the training of Micronesian teachers and the development of a basic curriculum adapted to the needs of the students. More effort was devoted to the teaching of English as a second language. Local community support of education climbed steadily in the past year. Increasingly, Micronesians are becoming qualified for responsibility in the school systems.

The Pacific Island Central School became a full 3-year secondary school, the only Government-operated school of this level in the Territory. Construction of new buildings for the school is under way in Ponape District. This new location will offer greatly improved facilities for agriculture and other vocational training in addition to regular scholastic courses. Work was also started on a new public intermediate school at Kusaie in the Ponape District. A number of elementary schools were built or rebuilt.

In its public health program the Territory began a B. C. G. vaccination program in the fight against tuberculosis and is thus among the first to use B. C. G. on a wide scale as an aid in tuberculosis prevention.

Four students departed for training at the Central Medical School at Suva, Fiji, and two graduates of the school assumed posts as medical practitioners in their respective home districts. Others are studying in the field of public health in Hawaii. Advanced training continues to be given Trust Territory dental practitioners by the United States Navy at Guam.

The school of nursing at Palau increased its enrollment. A series of textbooks for Micronesian student nurses were written and published. A school of sanitation was conducted in one district, with sanitarian trainees from all districts in attendance.

Land Compensation and Resettlement

The long-pending problem of compensation to the people of Bikini and Eniwetok for use rights to their islands was finally settled and payments made. Other land settlements are in process. A long-standing property claim by a Belgian family was settled and additional public domain lands were released for homesteading.

An event anticipated for several years took place in June 1957, when 250 inhabitants of Rongelap Atoll in the Marshalls were transported to their home atoll, after living at Ejit Island for 3 years following an accidental radioactive fallout at Rongelap. The move was made in co-operation with the United States Navy and the Atomic Energy Commission. Construction of a new village, including the building of homes and the planting of crops, was completed prior to the move at the expense of the Atomic Energy Commission.

GUAM

In October 1956, Richard Barrett Lowe was appointed Governor of Guam by the President after having served 3 years as Governor of American Samoa.

Several local residents have been appointed to positions in the Government of Guam formerly held by off-island contract employees. These include three department heads and the dean of the Territorial College. This is in keeping with the policy of placing qualified persons of Guamanian ancestry in responsible government positions.

During the year a team from the United States Public Health Service completed a survey of the Guam Medical Service Department.

New Legislature Meets

A general election was held in November for members of the 4th Guam Legislature, and for Municipal Commissioners. Out of 13,000 eligible voters there were 9,499 registered, of which 83.5 percent voted during the election. The November election won for the Popular Party all 21 members of the unicameral Legislative Body.

Seventy-one pieces of legislation were passed and approved during fiscal year 1957. Of major significance was an act to supply free text books for use in the public elementary and secondary schools of Guam, and an act to encourage the education and training of resident citizens and the utilization of these citizens in government service.

Other legislation passed and approved during the year included:

a zoning ordinance for Agana, an agriculture code, a health and sanitation code, an act establishing a public employment office, and an acceptance act making Guam eligible to receive grants-in-aid under the Federal Vocational Education Act.

High School Accredited

Three hundred and thirty-six boys and girls completed their high school education in the public schools of Guam during the past fiscal year. This was the largest class ever to graduate from George Washington High School. Another significant step in Guam's educational progress was the accreditation of the high school by the North Central Association in May 1957.

Public Works

During the past 12-month period, the work accomplished on capital improvement projects by the Department of Public Works represented a total expenditure of approximately $1,554,332. Major projects completed during the year were the new Guam Memorial Hospital, Merizo Pier, Price School, George Washington High School Cafeteria, Inarajan Junior High School, two recreation centers, additional street paving, improved area drainage, and additional government employee housing consisting of eight houses and a 20-unit apartment.

Plans for the construction of three elementary schools were also completed, which enabled the Territory to receive a United States Federal school construction grant for federally affected areas.

During fiscal year 1957 the commercial port handled 196,843 revenue tons valued at $33,308,230. From the excess revenue which has accumulated for several years at the port, the sum of $250,000 was transferred to the general fund to be used for additional capital improvements.

Additional appropriations were approved for continuing capital improvement projects which include highway construction and paving, improvement of parks, monuments, and the museum, construction of permanent school plants and purchases of collateral equipment, extension of power and water distribution lines, development of plans for construction of an administration building and a Territorial college, and construction and development of facilities at Paseo de Susana, the island's center for athletic and other recreational activities.

Expansion in Utilities

The public utility agency continued to expand its services throughout the Territory. During the year a major electrification project was completed providing electricity to two population centers in the southern sector of the island (Merizo and Umatac). By the close of the fiscal year, the extension of power and water services to the more populated sections of the island is well over 75 percent complete. It was also during the fiscal year that additional extensions were made in the telephone system. By June 30, 1957, over 800 homes and business establishments were connected to the telephone system, with 300 of these connections installed during the fiscal year.

AMERICAN SAMOA

The appointment of the first Samoan-born Governor in the history of American Samoa was made on October 15, 1956. The appointment was well received by the Samoan leaders and people.

Advances in Self-Government

In order to help the Legislature of American Samoa become familiar with the operations and practices of governmental systems elsewhere, a group of five members of the Legislature traveled to Honolulu in May 1957, to observe the Hawaiian Legislature in session. The operations of other government departments in Hawaii were also observed. This visit was of great value to the Legislature.

In its deliberations during a 2-week session in June 1957, the Legislature passed 46 resolutions on a variety of subjects. There is no doubt that, during the year, the Legislature of American Samoa has grown both in stature and prestige.

The participation of local leaders in the consideration and solution of policy problems was continuously sought by the administration and an increasing knowledge and appreciation of governmental affairs and responsibilities amongst Samoan leaders was evident. Visits to the districts, counties, and villages by the Governor, the Secretary, and department heads, and the discussion of problems at the village level during such visits contributed to this increasing participation in governmental affairs.

Signs of Increasing Prosperity

Economic activity continued at a relatively high rate. Employment, gross income, retail trade, and exports and imports increased. The fish cannery may now be considered a permanent Territorial industry. Many modern improvements and additions were made to the plant during the year.

Pago Pago continues to be a busy port. A total of 603 ships was cleared during the fiscal year 1957, as compared to 450 ships in 1956, and 279 ships in 1954. These figures do not include local interisland traffic between the islands of American Samoa nor vessels engaged in fishing for the cannery.

The visits of two Matson luxury liners every 3 weeks, with over 300 passengers on each vessel, and frequent visits of Navy ships have provided the territory with a considerable increase in income.

Letters of credit, loan applications and collections also continued to increase. As a further indication of the scope of business activity, the Territory had an excess of currency beyond its needs, for the first time under the administration of the Department of the Interior.

Preliminary engineering plans and testing of equipment, and final cost estimates for construction of the new commercial airstrip at Tafuna were almost completed at the close of the year. Fifty-five pieces of surplus heavy equipment were transferred from the Navy Department to the Government of American Samoa and were received in January 1957.

A drought during the first 6 months of the year placed a severe drain on food production for local consumption. As a consequence, planters are being advised to devote more attention to subsistence crops. The drought also handicapped industrial production. To assist the Territory in locating additional sources of water, the Geological Survey sent two technicians to American Samoa. Plans were being made to continue their water survey work during the fiscal year 1958.

THE VIRGIN ISLANDS

The most striking gain for the Virgin Islands in fiscal year 1957 has been the improvement in the fiscal position of the Virgin Island Government.

Revenues amounted to $3,690,539.29, an excess of $736,539.29 over estimates and an increase over fiscal year 1956 of $778,764.21. Principal gains were reflected in income tax, real property tax, customs duties, and trade and excise taxes. The cash balance in the general fund of the Treasury on June 30, 1957, amounted to $1,193,846.32, sufficient to cover all known outstanding obligations at the close of the fiscal year. For the first time in years, it was not necessary to borrow funds to finance the operations for the current fiscal year. Estimated returns from matching funds for fiscal 1957 should exceed $3 million.

Preliminary statistics on tourist travel indicate a gratifying increase in both visitors and total tourist expenditures over the previous year. Air traffic showed a large gain and over 50 cruise ships called at the islands. The islands again played host to thousands of servicemen. Six new hotel establishments opened or were reactivated during the year. The Virgin Islands carried out a tourist promotional campaign through newspaper and magazine advertising and an increased distribution of travel literature.

The Waterfront Highway in St. Thomas was completed at a cost of approximately $500,000. An extensive highway program in St. Croix was started and most roads in the three islands received fair maintenance. Two large schools were under construction in St. Croix, and the reconstruction of the Marine barracks building was completed for occupancy by various governmental agencies.

Water Shortage Problems Met

The greatest problem during the year was the water shortage in St. Thomas due to an unusually severe drought which began in November 1956 and was still continuing at the close of the fiscal year. Only 27.76 inches of rain fell during the year. This was 20 inches less than the previous year and 17 inches below the annual average. It was necessary to haul from Puerto Rico over 33 million gallons of water by Navy and commercial barge and by the Virgin Island's own barge.

Health, Education, and Welfare

Organization of the medical staffs in the two insular hospitals, a step toward accreditation, was completed. The polio vaccination program for children of school age attained its peak and an adult polio vaccination program was launched during May of 1957. The Health Department participated in the First Caribbean Conference on Mental Health held at Aruba, N. W. I. The Virgin Islands Commissioner of Health, was named chairman of the committee to draft plans for a Caribbean Federation of Mental Health.

Approximately 6,000 children attended public schools and 2,390 were enrolled in private schools during the year. A Board of Vocational Education was appointed and the vocational rehabilitation program began operation in March 1957. The Bureau of Libraries met requirements for participation in the Federal library service program. A Youth Center was opened in Cruz Bay, St. John, through the efforts of the Youth Commission. In the teacher-training program seven courses were offered in the 1956 summer session of the Virgin

Islands Experimental College and three courses during the school year.

The Virgin Islands benefitted from new Federal legislation which increased Federal participation in Virgin Islands social welfare assistance programs. Matching funds were provided for parents of dependent children and the annual limitation on overall Federal participation was increased from $160,000 to $200,000.

Other Departments Show Progress

The Department of Public Safety initiated an in-service training program for the men in the Police Division under the direction and supervision of the Federal Bureau of Investigation. Two-way radio communication linking the islands of St. Thomas, St. Croix, and St. John and radio equipped motorized units were installed. A centralized record bureau, a unified interisland traffic program and a unified criminal investigation bureau under the supervision of the insular chief of detectives were being perfected.

The Department of Agriculture and Labor promoted increased cooperation between producers, distributors, and consumers of food products. It also conducted a program for the vaccination of hogs, which resulted in the control and near eradication of hog cholera and, in cooperation with the Federal Government, started a program for the control of brucelosis.

VIRGIN ISLANDS CORPORATION

The Virgin Islands Corporation was established to develop the economy of the Virgin Islands and was chartered for a period of 10 years beginning July 1, 1949. Its principal operations include the production and manufacture of raw sugar, the generation and distribution of electric power, and the conduct of a loan program and various agricultural development projects.

The 1957 sugarcane crop was the most successful in the history of the Corporation. As a result the Corporation showed a profit for the first time; the amount $215,544. The sugar operation, as a whole, showed a profit amounting to $78,048. A total of 132,415 tons of sugarcane were ground and 14,789 tons of 96° raw sugar were manufactured. Facilities for the handling and storage of bulk sugar were installed during the year and it is expected that this changeover will result in substantial savings in shipping costs.

The sale and distribution of electric power has increased approximately 20 percent over the past 4 years. A project to provide power to the Island of St. John was completed during the year with the installation of a submarine cable between St. Thomas and St. John.

Under the soil and water conservation program, 13 earth dams, 2 in St. Thomas and 11 in St. Croix were constructed. A total of 780 acres of land were cleared on St. Croix under the land clearance program. These two programs have contributed substantially to the overall agricultural development of the islands. The dam program in particular has been oustandingly successful. Over 3,500 mahogany seedlings and some 9,000 teak trees were planted on public and private lands during the year. A sawmill was set up for the processing of timber, particularly mahogany, and a large number of trees blown down in the 1956 hurricane were cut. It is expected that the wood products obtained will be utilized in the development of local industries.

The operation of the properties located on St. Thomas, formerly utilized by the Navy and presently assigned to the Secretary of the Interior from the Navy under a use permit, has continued most successfully. Income from these properties increased substantially over the previous year. The funds derived are utilized for operating expenses and for maintaining the properties in good condition.

Office of the Assistant Secretary
Fish and Wildlife

Ross L. Leffler, *Assistant Secretary*

THE ASSISTANT SECRETARY for Fish and Wildlife discharges the duties of the Secretary with respect to the Department's programs in the field of fish and wildlife. He is responsible for the secretarial supervision and direction of the United States Fish and Wildlife Service under the Commissioner of Fish and Wildlife and its Bureau of Sport Fisheries and Wildlife and Bureau of Commercial Fisheries.

Two significant developments to have great impact on Federal activities in fish, shellfish, and wildlife resource management took place during the past year. The first was the reorganization of the Service under the Fish and Wildlife Act of 1956 and the second was the initiation of a sweeping planning effort for a vigorous, new 10-year program for fish and wildlife.

The Fish and Wildlife Act created the position of Assistant Secretary for Fish and Wildlife and the post of Commissioner of Fish and Wildlife. It also established the United States Fish and Wildlife Service consisting of two agencies with bureau status—the Bureau of Commercial Fisheries, responsible for matters relating primarily to commercial fisheries, whales, seals, and sea-lions, and the Bureau of Sport Fisheries and Wildlife, responsible for matters relating primarily to migratory birds, game management, wildlife refuges, sport fisheries, sea mammals (except whales, seals, and sea-lions). Reorganization took effect on November 6, 1956, and its implementation through the appointments of personnel to head the new bureaus and fill supporting staff roles has been a continuing process.

A task force in both Commercial Fisheries and Sport Fisheries and Wildlife, composed of staff members from central office and the field, was established and early in 1957 began to review the needs and develop projects to meet them in these important areas of natural resource management. Service personnel, as well as State and private agencies dealing with commercial and sport fisheries and wildlife, were canvassed for suggestions. As the fiscal year ended, the new program was nearing final form for submission to the Secretary.

In the field of waterfowl management, the year was one of productive effort. The development of flyway management plans was initiated as a partnership effort of the Service and the State fish and game departments through the Flyway Councils. The plans will spell out research and management activities which are needed, including acquisition and development of key areas. The preservation of 12 million acres in a basic network of strategically distributed wetlands is held necessary to perpetuate the waterfowl resource. Long ago, a goal of 7,500,000 acres of lands for waterfowl in Federal ownership and management was established. There are now 3,270,000 acres in the 205 Federal waterfowl refuges. Accelerated destruction of wetlands in the past 20-odd years emphasizes the need for stepping up this acquisition program.

In the field of wildlife research, increased attention is being given to the use of pesticides to determine their effects on wildlife and how that can be minimized. There was progress also in correlating mosquito control with waterfowl habitat improvement work. Investigations into ways to reduce blackbird depredations were equally accelerated.

The Federal aid in wildlife and fisheries restoration continued to produce effective research and management programs in the States and the Territories.

To help management maintain fishery populations in waters where natural production cannot keep pace with mounting angling pressure, funds for the construction of six hatcheries were secured from the Congress. Trout production from existing hatcheries also was increased. Under reorganization, plans for expanded fishery management field services were developed.

Water development projects either conducted by, or with financial assistance or under license of the Federal Government continued to receive the careful examination of the Service to determine their effects on fish and wildlife. A total of 340 such reports were issued. Efforts to amend the Coordination Act of 1946 to provide for enhancement of fish and wildlife values in such projects instead of just mitigation of damages also were initiated, and the governors of the 48 States endorsed this action.

Predator and rodent control activities involved an intensified effort to evaluate new rodenticides, repellents and scare devices, leading to the improvement of techniques for keeping troublesome wildlife populations in check.

In the commercial fisheries field, the Fish and Wildlife Act of 1956 triggered a number of important advances. Fishermen in the industry were given substantial financial assistance through a $10 million loan fund which the act established. Loans for financing and refinancing of operations, replacement, repair and maintenance of gear and vessels, and for research into fisheries problems are provided. Before the end of the year, applications had crossed the 10 million mark.

The act also made permanent the Saltonstall-Kennedy program which makes available 30 percent of customs duties on fishery products imports to underwrite research and services to improve markets for domestic fishery products. These activities were greatly stimulated.

Another important advance was in the development of voluntary United States standards for fishery products. Standards for frozen fried fish sticks became effective and several other standards were in process of development. Commercial utilization also was developed for a deep-water royal-red shrimp found by one of the Bureau's exploratory fishing vessels off the southwestern coast. As a result of another of these studies, a new shrimp fishery also has been developed off the State of Washington.

In the market development program, 244 fish-cookery demonstrations were given school lunchroom, institutional and other groups and two new motion pictures were finished and placed in circulation. Expansion of market news coverage also was initiated to improve this service for the industry.

Signs of progress in the restoration of Alaska's salmon fisheries as a result of the measures taken by the Bureau also were noted. Production of canned salmon rose and at the same time there were improved escapements of salmon to spawning streams. Research efforts in this important fishery received greater emphasis to provide the answers needed for pressing management questions.

In the international fishery field, where the United States is a member of a number of commissions, it was also a year of progress. Advances were recorded in the North Pacific salmon studies, through new regulations for the New England haddock fishery, and in the tuna investigations. The lamprey control program in the Great Lakes also was improved.

FISH AND WILDLIFE SERVICE

Arnie J. Suomela, *Commissioner of Fish and Wildlife*

THE LAST fiscal year has been a period of extensive reorganization. On August 8, 1956, the President approved the Fish and Wildlife Act of 1956, Public Law 1024 of the 84th Congress. This law provided that the United States Fish and Wildlife Service should be established, to replace the former Fish and Wildlife Service, and that it should consist of two Bureaus, a Bureau of Sport Fisheries and Wildlife and a Bureau of Commercial Fisheries. It provided also that the new Service should be administered under a Commissioner of Fish and Wildlife, subject to the supervision of an Assistant Secretary for Fish and Wildlife.

The Secretary of the Interior, on November 3, 1956, declared the reorganization effective as of the close of business November 5, and designated John L. Farley (previously Director of the Fish and Wildlife Service) as Acting Director, Bureau of Sport Fisheries and Wildlife, and Arnie J. Suomela (previously Associate Director of the Fish and Wildlife Service) as Acting Director, Bureau of Commercial Fisheries. Pending the appointment of a Commissioner and an Assistant Secretary, the two Bureau chiefs reported directly to the Secretary. Mr. Farley resigned as Acting Director, effective February 8, 1957, and Robert H. Johnson was designated Acting Director, February 11.

On January 2, 1957, Ross L. Leffler entered on duty as Assistant Secretary for Fish and Wildlife (appointment confirmed by the Senate, February 11). On February 15, announcement was made of the general composition of the new Service and its two Bureaus as follows:

The Office of the Commissioner of Fish and Wildlife, with his immediate staff and the Offices of Information, International Relations, and Program Review.

The Bureau of Commercial Fisheries, with the Office of the Director, an Office of Loans and Grants, and four Divisions: Administration, Biological Research, Industrial Research and Services, and Resource Management. Its field organization consists of four regional offices in the continental United States and one in Alaska under Regional Directors, a Pacific Oceanic Fisheries Investigations Office in Hawaii, and approximately 80 subordinate field installations.

The Bureau of Sport Fisheries and Wildlife, with the Office of the Director and four divisions: Administration, Sport Fisheries, Technical Services, and Wildlife. The field organization consists of five regional offices in the continental United States and one in Alaska under Regional Directors, and approximately 500 subordinate field installations.

On February 18, Arnie J. Suomela was nominated Commissioner of Fish and Wildlife (appointment confirmed by the Senate, March 29). On March 14, Daniel H. Janzen was designated as Director, Bureau of Sport Fisheries and Wildlife. On April 25, Donald L. McKernan was designated as Director, Bureau of Commercial Fisheries. On June 2, the former regional offices of the Fish and Wildlife Service became regional offices of the Bureau of Sport Fisheries and Wildlife. Action is now proceeding to establish regional offices of the Bureau of Commercial Fisheries.

In the following summaries of the year's operations, activities have been grouped generally under the Bureau in which they will continue, although the distribution of functions has been a progressive one throughout this period of reorganization.

BUREAU OF SPORT FISHERIES AND WILDLIFE

Daniel H. Janzen, *Director*

COOPERATION IN WILDLIFE REFUGE MANAGEMENT

THE national wildlife refuge program continued to provide major benefit to the migratory waterfowl resource of the North American Continent. This program embodies three basic objectives: The protection of migratory birds, leading always to the annual provision of an adequate residual broodstock to perpetuate the resource; the preservation through Federal ownership of a basic segment of the overall waterfowl breeding, intermediate, and wintering habitat; and the protection and preservation of indigenous species of birds, mammals, and other wildlife and their habitat.

Intensive use by millions of ducks and geese on most refuges along the four flyways provides proof that these areas are enabling the Bureau to carry out responsibilities under the migratory-bird treaties with Canada and Mexico.

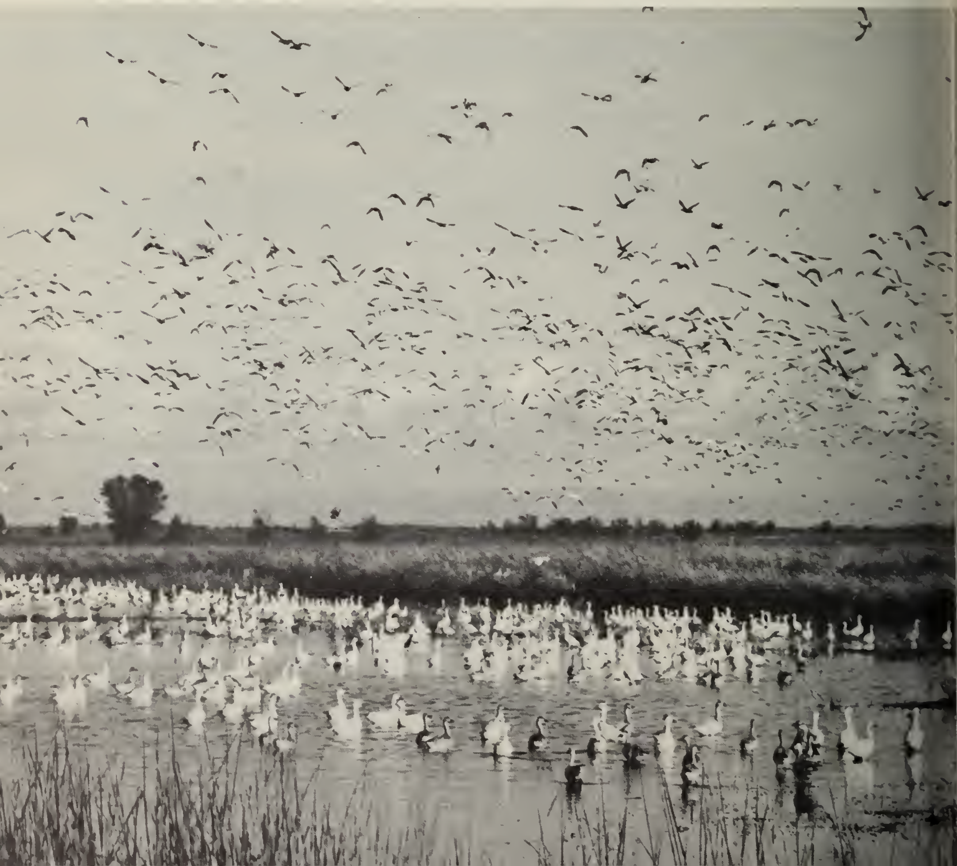
Despite all that has been done over the years, the needs of waterfowl are in ever-growing competition with the requirements of an expanding human population. The draining of marshes for agricultural improvement, and for metropolitan and community growth, poses problems that will be most difficult to solve. For years past we have watched marshes and ponds disappear as agriculture has expanded, particularly in the prairie-pothole region of Minnesota and North and South Dakota. These areas were the most productive waterfowl lands in the United States, fully equal to the best producing areas in Canada.

Similar drainage is occurring in many coastal sections, which are most important to the birds as wintering grounds. Most of the great natural marshes of the Gulf are being ruined or seriously damaged for waterfowl use by salt-water intrusion as a result of the intracoastal and connecting canals, and by exploration for sulfur and oil.

Waterfowl of the Pacific flyway are rapidly approaching a crisis because the lush marshes which once supported myriads of birds wintering in California and northern Mexico are being turned into cotton and rice fields, orchards, and urban developments.

Thus we see waterfowl facing a precarious and uncertain future, and in years to come increasing reliance will probably have to be on lands dedicated to their needs—lands in the ownership of the Federal Government and the States, or in the ownership of people with a love of wildlife. At the same time, acquisition of such lands will increasingly be in competition with other human uses, and therefore only at competitive prices. The need for an accelerated acquisition and development program faces us now.

FIGURE 35.—Some 273 national wildlife refuges provide 17,361,141 acres of habitat for American migratory birds and other animals. Thousands of snow and white-fronted geese like these are to be found at Sacramento National Wildlife Refuge each year.



In 1934 a careful study of our waterfowl resource showed that originally we had approximately 120 million acres of marsh and wetlands. Fewer than 30 million acres of habitat of good quality for waterfowl remain today. In 1934, on the basis of the existing waterfowl population and future requirements of the waterfowl resource, it was felt that the Federal Government should own and develop 7,500,000 acres. That estimate has stood the test of time. We are almost halfway to that goal now with 205 waterfowl refuge areas, totaling 3,270,000 acres.

We still need about 4 million acres, and we need them very soon because of the greatly accelerated destruction of waterfowl habitat and the great increase in the number of waterfowl hunters.

During fiscal year 1957 long-range development plans were prepared by each of the refuge managers. Summaries of these projects, by priorities, have been prepared for an accelerated development program over a 10-year period. This program covers not only the development on the 205 waterfowl refuges but also on big-game areas, wildlife monuments to protect endangered species, and on other lands needed to insure future waterfowl needs.

The United States Air Force and the United States Fish and Wildlife Service signed an agreement establishing an Air Force-wide fish and game conservation program. Many air bases in the United States and its Territories are located on vast reservations where fish and game are plentiful. With the program as now planned, the Air Force hopes to join with local, State, and Federal conservation organizations in the protection and control of wildlife. This Bureau is aiding the Air Force by providing, within the limits of available funds and personnel, technical assistance in preparing fish and wildlife development and management plans, and related services.

The United States Department of the Navy, desiring to establish a Navy and United States Marine-wide program to manage renewable resources on all lands under their control, created an advisory group of civilian specialists for guidance and counsel.

Agreement was reached with the Bureau of Land Management which offers a solution to the problem of preserving the Alaska brown bear. A cooperative agreement entered into this year between the Bureau of Indian Affairs, Bureau of Land Management, and this Bureau will result in proper management of the Alaskan reindeer resources in the wild.

Over a 5-year period personnel on the 116,000-acre White River National Wildlife Refuge in east-central Arkansas endeavored to secure cooperative agreements with the four Soil Conservation Districts in which the refuge is located. At a meeting this year, with all districts represented, a cooperative forestry management program on the

White River Refuge was outlined. The various Boards not only endorsed the program but urged additional operating funds to further the conservation program. Agreements between Soil Conservation Districts and National Wildlife Refuges have now been completed on 61 areas.

TABLE 1—*Acreage acquired or in process of acquisition by Fish and Wildlife Service for wildlife conservation purposes*

State and refuge [1]	Acquired in fiscal year 1957			Pending title conveyance
	By other than purchase	By purchase	Total	
California: Salton Sea		3	3	
Colorado: Monte Vista		1, 291	1, 291	4, 029
Florida:				
National Key Deer Refuge	1		1	
St. Marks				1, 649
Sanibel	474		474	
Georgia:				
Okefenokee				1, 799
Piedmont		398	398	
Illinois: Upper Mississippi River	288		288	
Kansas: Quivira		2, 184	2, 184	1, 916
Kentucky:				
Kentucky Woodlands				236
Reelfoot				79
Louisiana: Catahoula				5, 199
Maine: Moosehorn		1	1	
Maryland: Martin				1, 377
Michigan: Shiawassee		232	232	207
Minnesota:				
Rice Lake				56
Tamarac				1, 032
Upper Mississippi River		37	37	356
Mississippi: Noxubee		898	898	3
New Jersey: Brigantine		40	40	8
New Mexico: Bitter Lake		240	240	
New York:				
Elizabeth Alexandria Morton	75		75	
Wertheim				8
North Dakota:				
Chase Lake				1, 349
Long Lake				160
Lower Souris		40	40	
Tewaukon		240	240	1
Oklahoma: Tishomingo	3, 170		3, 170	
Oregon:				
Malheur		1, 489	1, 489	
McKay Creek	24		24	36
South Carolina:				
Cape Romain	51		51	
Santee		202	202	3, 034
Texas: Laguna Atascosa		961	961	
Vermont: Missisquoi		617	617	11
Washington:				
Columbia		807	807	1, 404
Willapa		410	410	
Wisconsin: Upper Mississippi River	21		21	
Total	4, 104	10, 090	14, 194	23, 949

[1] Name includes "National Wildlife Refuge" except as indicated.

TABLE 2.—*Acreage of public domain reserved for wildlife conservation purposes and administered by the States*

State and unit	Acres
Idaho: Carey Lake Migratory Bird Management Area	320

The continued use of National Wildlife Refuges for recreational purposes in 1956 increased about 8 percent. Of the 7½ million visitors to these areas last year, about 2,765,000 enjoyed sport fishing. Some type of hunting, including archery, was provided on 71 refuges for 435,000. Picnicking, swimming, boating, photography, and nature study were the principal categories into which the remaining 4,355,000 were classified. On certain refuges, such as Aransas and Santa Ana in Texas, all of the visitors were attracted by the opportunities afforded for wildlife observations. Many of the 15,000 visitors on Aransas made use of the new observation tower in order to see whooping cranes near at hand.

GAME MANAGEMENT

Phases of management which concern the regulation of the harvest continue to be of particular concern. There has never been a time in the history of this country when regulation of human behavior was more important to the preservation of our migratory game bird heritage. The Bureau has been particularly cognizant of the need for careful analysis of data concerning hunter movements as well as population numbers, production, distribution, and harvest of migratory game birds.

The development of regulations embraces a multiplicity of problems. It is necessary to consider carefully not only the data obtained from breeding-ground surveys, wintering surveys, and harvest surveys, but also the distribution of the birds throughout the migration pattern. The relation of distribution to hunter activity and movement is becoming more and more important as management becomes more intensive. Public relations and cooperation with State game departments and private conservation organizations are commanding more attention. The fields of enforcement and of control of depredations by migratory game birds have broadened in scope, and the personnel have broadened their activities correspondingly.

There has been a continuing emphasis on an extensive law-enforcement program. An effective and essential tool of management, this program is carried out in close cooperation with enforcement personnel of State game departments and other agencies. Among cases prosecuted during the year were those of 53 market hunters charged in Federal courts of Texas with unlawful possession and sale of migratory waterfowl. Penalties imposed in these cases ranged from fines of $500 and imprisonment for 6 months to fines of $50 in the case of two youths who were accomplices of an adult offender. Ten defendants were placed on probation for 3 years, and two for 2 years, and forbidden to hunt migratory game birds while on probation. These cases and a comparable number successfully prosecuted shortly before the close of the preceding fiscal year resulted from a 2-year undercover operation along the Texas coast (a major wintering area for ducks and geese). Its beneficial effects were evidenced during the 1956–57 hunting season by much better compliance with Migratory Bird Treaty Act regulations in that area.

Agents individually and in cooperation with State law-enforcement officers apprehended 4,790 persons who were charged in State courts with various violations of State game and fish laws. Of these cases 2,788 involved unlawful taking or possession of migratory birds and unlawful interstate transportation of birds, mammals, and fish. Many of these cases involved violation of both State and Federal laws. Fines in the cases disposed of in the State courts aggregated $170,067 (of which $6,627 was suspended) and jail sentences totaled 1,739 days (of which 1,326 days were suspended).

During the year, 250 cases involving violations of the Alaska Game Law were terminated. In addition there were four convictions in Alaska for violations of the Migratory Bird Treaty Act and three for violations of the Migratory Bird Hunting Stamp Act. Fines aggregated $21,718 (of which $3,576 was suspended) and jail sentences totaled 2,030 days (of which 870 were suspended). Forfeitures resulting from violations of the Alaska Game Law included 36 firearms, 156 licenses, 87 furs, 47 big-game animals, 1 walrus head, and 25 game and nongame birds. In all types of cases handled by Bureau agents during the year, the rate of conviction was approximately 99 percent.

Modern transportation equipment such as marsh buggies, airthrust boats, aircraft, 4-wheel drive vehicles, and amphibious craft have added to the difficulties of game-law enforcement by opening up hunting areas that were formerly remote and difficult of access. By use of like equipment and by ingenuity and resourcefulness, Bureau enforcement agents have succeeded in bringing law to such areas. High-power spotting scopes have been provided agents, enabling them to make observations over a wide area and at comparatively long ranges. Two-way portable radio equipment is being used to very good advantage and is one of the best means of coordinating patrol activity and making most effective use of available manpower.

In gathering data for use in formulation of regulations, Bureau personnel conducted extensive waterfowl breeding surveys and banding projects in collaboration with State and Provincial game departments, the Canadian Wildlife Service, Ducks Unlimited, and the Wildlife Management Institute.

With the exception of Mexico, the midwinter waterfowl population survey was again carried out, as were the post office hunter kill survey and a limited winter banding program.

Particular consideration was given this year to the development of flyway management plans for waterfowl. Discussions on these management plans were held at meetings of flyway councils at the same time as discussions of the migratory bird regulations. These meetings were particularly helpful in developing better public understanding of regulatory problems.

Table 3.—*Cases disposed of in Federal courts (exclusive of Alaska) involving violations of wildlife conservation laws administered by the Bureau of Sport Fisheries and Wildlife, fiscal year 1957*

	Pending July 1, 1956	New cases	Pending June 30, 1957	Terminated	Fines and costs	Jail sentences (days)
Migratory Bird Treaty Act	532	743	417	853	$48, 452	1, 570
Migratory Bird Conservation Act	48	129	24	153	4, 193	----------
Migratory Bird Hunting Stamp Act	29	127	14	142	3, 705	45
Lacey Act	----------	16	----------	16	1, 175	----------
Black Bass Act	2	2	2	2	450	----------
Bald Eagle Act	1	5	2	4	159	----------
Halibut Act	----------	2	2	----------	----------	----------
Sockeye Salmon Act	1	6	1	6	600	----------
Assault Act	2	5	2	5	1, 700	----------
Total	615	1, 035	464	1, 186	[1] 60, 434	[2] 1, 615

[1] Includes $2,575 suspended.
[2] Includes 845 days suspended.

MAINTAINING THE ISLAND FISHERIES

The Fish and Wildlife Service operated 92 hatcheries and propagated 24 species of fish for distribution to inland waters during the year.

Activities under the Columbia River fishery development program went forward at an increased pace. The end of the fiscal year found most construction funds committed for projects to get under way during the summer. This year, the Idaho Fish and Game Department entered the program, with investigations, installation of test screens, and development of plans for future construction.

Congress provided funds to initiate the construction of new hatcheries at Cedar Bluff (Kansas), Gavins Point (South Dakota), Pisgah National Forest (North Carolina), Paint Bank (Virginia), Bowden Springs (West Virginia), and Miles City (Montana); and to replace major facilities at Pittsford (Vermont). Congress provided funds also to continue the construction of new hatcheries at Millen (Georgia), North Attleboro (Massachusetts), and Pendills Creek (Michigan), and to improve and expand facilities at Hagerman (Idaho), Creston (Montana), Ennis (Montana), Williams Creek (Arizona), Inks Dam (Texas), Springville (Utah), Charlevoix (Michigan), Marion (Alabama), Welaka (Florida), and Chattahoochee Forest (Georgia). Construction of a new trout hatchery at Jackson (Wyoming) was started by the Service with funds supplied by the Bureau of Reclamation.

Trout production at Federal hatcheries was increased approximately 10 percent by weight above any previous year. This increase was effected through the use of expanded and modernized facilities provided under the expansion program and through the application of improved techniques in fish culture. In addition to providing trout to stock waters on Federal lands, Federal hatcheries supplied the fish necessary to supplement State production programs. As an example of this assistance, the States of Pennsylvania and West Virginia received large numbers of legal-sized trout from Federal hatcheries to implement the State stocking programs when a significant portion of their own production had been lost through severe fish kills. In cooperation with New Mexico's Department of Game and Fish, the Service obtained a new strain of rainbow trout from Mexico. These fish were shared with the States of New Mexico and California, where progeny from this original stock are expected to survive and reproduce in waters now regarded as marginal. Studies on trout nutrition and the training program for trout-culturists were continued at the Cortland (New York) Fish-cultural Station in cooperation with the State of New York and Cornell University.

Drought conditions in major areas of the Nation were alleviated during the year. As heavy rains filled ponds and reservoirs, the demand for warm-water fish for restocking rose to an alltime high. Although the production of pondfish at Federal hatcheries was at approximately the same high level as in the previous year, this production was not sufficient to meet the increased demand. Channel-catfish production continued to gain in importance, especially in the southwestern and south-central States. More emphasis was placed on the production of walleyes and northern pike in the North Central region. The training of warm-water fish-culturists continued at the Marion (Alabama) station; use of improved techniques in the control of pondweeds, fertilization, and disease control formed part of the training program.

The use of air transportation for fish was increased; several large consignments were transported successfully to distant points. Parcel-post shipments of live fish in plastic bags were successful, but additional experiment will be necessary before this type of shipment can be considered practical.

The fishery-management services to Defense installations, Veterans Administration hospitals, Indian reservations, and wildlife refuges were particularly successful. Although services to hatcheries were limited by the small number of biologists available, these services contributed materially to the overall production of fish at Federal hatcheries.

TABLE 4.—*Fishes and fish eggs distributed—calendar year 1956*

Species	Eggs		Fry		Fingerlings		Fish 6 inches or larger		Total	
	Number	Weight	Number	Weight	Number	Weight	Number	Weight	Number	Weight
		Pounds		*Pounds*		*Pounds*		*Pounds*		*Pounds*
Largemouth bass			436, 850	78	14, 420, 426	27, 745	3, 712	962	14, 860, 988	28, 785
Smallmouth bass			25, 000	1	76, 714	153			101, 714	154
Bluegill					47, 844, 044	65, 151	4, 282	1, 142	47, 848, 326	66, 293
Redear sunfish			600	3	948, 424	1, 879	4, 255	696	953, 279	2, 578
Black crappie					565	4			565	4
Channel catfish					841, 061	8, 003	64, 615	4, 497	905, 676	12, 500
Bullhead					19, 310	478	100	125	19, 410	603
Buffalofish					50	2			50	2
Walleye			1, 865, 800	34	608, 755	446			2, 474, 555	480
Northern pike			12, 723, 000	296	1, 671, 513	1, 230	610	65	14, 395, 123	1, 591
Cutthroat trout			253, 010	57	430, 777	1, 790	35, 029	7, 386	718, 816	9, 233
Rainbow trout	2, 835, 431	519			11, 405, 118	170, 264	2, 938, 925	699, 176	17, 179, 474	869, 959
Steelhead trout	47, 627	13			74, 282	4, 385	289, 636	27, 824	411, 545	32, 222
Lake trout					695, 469	8, 111	248, 118	17, 200	943, 587	25, 311
Brook trout	3, 679, 086	524	300, 000	50	916, 171	16, 883	728, 440	170, 807	5, 623, 697	188, 264
Brown trout					517, 205	6, 611	383, 836	100, 576	901, 041	107, 187
Grayling			257, 070	25					257, 070	25
Pink salmon			493, 000	325					493, 000	325
Chum salmon	7, 400	6	3, 349, 140	2, 683					3, 356, 540	2, 689
Coho salmon	60, 144	48			893, 766	18, 873			953, 910	18, 921
Sockeye salmon	500, 000	130			4, 109, 300	51, 675			4, 609, 300	51, 805
Kokanee			5, 176, 480	794					5, 176, 480	794
Chinook salmon	3, 088, 260	2, 061	1, 298, 846	1, 212	53, 230, 544	426, 683			57, 617, 650	429, 956
Atlantic salmon			96, 738	60	284, 412	2, 033			381, 150	2, 093
Total	10, 217, 948	3, 301	26, 275, 534	5, 618	138, 987, 906	812, 399	4, 701, 558	1, 030, 456	180, 182, 946	1, 851, 774

Although the production of trout increased and pondfish production was at a high level, the need for fish for stocking purposes exceeded the combined production of State and Federal hatcheries. Perhaps the greatest single factor contributing to the trout fishery of the future is the new trout areas that are being created below large dams on major river systems. As demands upon the sport fishery are expected to increase annually, the necessity for planning and for cooperation between agencies charged with the management of the resource has become more and more obvious.

The attached tabulation is a summary of data on the production and distribution of fish from Federal hatcheries in the calendar year 1956.

Table 5.—*Acreage acquired or in process of acquisition for fishery installations*

State and station	Acquired in fiscal year 1957			Pending title conveyance
	By other than purchase	By purchase	Total	
Massachusetts: Woods Hole FBS	1		1	
Mississippi: Pascagoula Fishery Lab. (CFS)	2		2	
Montana: Miles City FCS	168		168	
Vermont: Pittsford FCS				2
Washington: Little White Salmon FCS	211		211	
Total	382		382	2

Abbreviations:
CFS—Commercial fishery station.
FBS—Fishery biology station.
FCS—Fish-cultural station.

WILDLIFE RESEARCH

During the school year of 1955–56, 176 wildlife students were graduated from schools in the Cooperative Wildlife Research Unit program. This brings the total of such graduates to 2,549. For 21 years this program, carried on jointly by the United States Fish and Wildlife Service, the Wildlife Management Institute, and land-grant colleges and conservation departments of 16 States and the Territory of Alaska, has facilitated the training of wildlife personnel needed to implement wildlife-management programs. These units have conducted research on a wide variety of wildlife species and wildlife-habitat problems, promoted conservation education and extension, and provided technical assistance to conservation agencies.

Wildlife research this year has been channeled into two primary lines of investigation: (1) studies to maintain or increase populations of desirable wildlife species, and (2) studies to develop methods of controlling or reducing undesired species to levels consistent with man's economic interests.

The first of these lines of investigation involves inventorying the wildlife species and determining their status and distribution. As in any business, it is essential to know what we have to work with.

The second primary line of investigation was concerned with the development of animal-control methods. Studies were made of blackbird damage to corn, and a leaflet (WL–385) summarizing methods of control was issued for the benefit of corngrowers. Earlier work done by Service investigators on the blackbird-rice problem in Arkansas was published in Bulletin 584 of the Arkansas Agricultural Experiment Station. Preliminary investigations were made on the effects of nutria on marsh vegetation and the damage these animals do to levees and rice and sugarcane crops, in an effort to determine the economic status of this large rodent.

In the vast timber-growing regions of the United States, seedeating rodents and birds and browsing game animals seriously retard reforestation. The Service's two Wildlife Research Laboratories are screening hundreds of chemicals annually to find new tools to aid the forester, game manager, and landowner. They are striving to find better seed protectors than those already developed, and to extend that protection to the growing plant by using chemicals that are absorbed by the seed and retained temporarily in the plant after germination.

The use of tracking powders, whereby an animal ingests a lethal agent through grooming and cleaning its fur, offers a new approach for the removal of offending rodents. During the year three new rodenticides were registered and made available to the public. Food-habits studies of the pocket gopher pointed the way to better methods of controlling these locally destructive rodents. Progress was made in making the "coyote-getter" less hazardous to the public and more effective against coyotes and wolves.

Some 40,000 mourning doves were banded this year; this banding coupled with taxonomic studies, should provide a sounder basis for the annual dove-hunting regulations. Increased attention was given to the analysis of waterfowl-banding data, particularly those for the mallard, black duck, and canvasback, and plans were made for additional banding in critical areas. Followup studies were made on the white-winged dove in cooperation with State and private conservation agencies, and a long report on this species is being prepared.

Studies along the Atlantic coast indicated a practical way of correlating mosquito control with waterfowl-habitat improvement. Creation of marsh impoundments with stable water levels, useful to waterfowl and fish, resulted in production of fewer nuisance mosquitoes than in comparable unimpounded marshes. New herbicides for destroying cattails and phragmites were tested, and considerable progress was made toward a practical chemical control for alligatorweed, one of the worst pest aquatics of the Southeast.

Research on farmland wildlife was carried out largely through the Patuxent Research Refuge and the Cooperative Wildlife Research Units. Patuxent studies have demonstrated that it is possible to produce good populations of farm game and at the same time produce excellent yields of corn, hay, and small grains, on land that had been abandoned as submarginal for agriculture. Some agricultural trends such as increased use of pesticides threaten to eliminate or reduce this important game resource unless safeguards are provided; pesticides are being studied in an effort to keep to a minimum their harmful effects on wildlife.

Timber-stand improvement, particularly in the South, has become a problem of major concern to those interested in forest wildlife. Tree mast, particularly acorns, is an important component in the diet of game birds and mammals. In many areas, elimination of acorn-bearing trees to make room for pine reproduction has drastically reduced the game-carrying capacity of the timberlands. Increased research is also needed on the use of herbicides to improve game range and to develop less harmful methods of application. It has been shown in the Lake States, for example, that mountain maples that have grown out of reach of deer can be top-killed with herbicides so that sprout growth is made available.

Diseases and parasites constitute an important natural means of limiting wildlife populations. During the past year studies were made of trichomoniasis, a throat disease that has caused high mortality among wild doves, and of aspergillosis in waterfowl. This fungus disease of the lungs and air sacs of ducks, geese, swans, and other birds has been associated with moldy grain; an attempt is being made to develop methods of diagnosis. In the West, scientists are tackling with increasing success the problems of avian botulism and fowl cholera, and are perfecting methods of diagnosis.

FEDERAL AID TO THE STATES

Wildlife Restoration

As in preceding years, the most important type of research carried out by the States under the Federal aid in wildlife restoration program was the collection of information about game-animal populations, reproduction success, and sportsmen's harvest. Inventory studies of this type were covered by 188 projects.

Increased cooperation among States has been highlighted as States realized the advantages of a coordinated approach toward common problems. For example, all waterfowl studies are now coordinated through State-sponsored flyway councils, most of the States are cooperating with the Federal Government in banding mourning doves, and the Southern States have established a regionwide disease and nutrition study of deer, to be carried out by the University of Georgia.

The foreign game bird introduction program was continued with the delivery of 730 birds of three species from Spain and Pakistan.

During the fiscal year 285 publications—books, bulletins, and magazine articles—appeared in print, an important yardstick of program accomplishments.

Acquisition of land for wildlife management continued at an accelerated rate; 254,332 acres were leased or purchased with Pittman-Robertson funds during the year. In 11 projects, wildlife funds were combined with fish-restoration funds to acquire 11,873 acres and to lease 300 acres.

In operation were 329 wildlife-development projects aimed at producing benefits for all native wildlife species. Planting of trees, shrubs, aquatics, or herbaceous crops was carried out on a nationwide scale. Marsh impoundment for waterfowl and mammals continued to be an important activity, with 28 States using Pittman-Robertson funds to create new areas and improve existing areas. Over 5,000 acres of new marsh were created in 25 major construction jobs. Eleven lakes, exceeding 3,000 acres with benefits to both waterfowl and fish, were created in combination projects.

Additional facilities for hunter use of game ranges were established by 39 States and Hawaii; access roads and trails, parking areas, sanitary facilities, and directional and regulatory signs were installed. Twenty-eight States stocked new ranges or trapped animals for study purposes. Thirty-seven States reviewed the effectiveness of their wildlife-improvement activities through special evaluation projects.

Other activities included the erection of wood-duck and squirrel nesting boxes, weed, disease, and predator control, thinning forest lands, and salt distribution.

Fish Restoration

Fisheries investigations concerning a variety of important sport fish were carried out by the States in 139 projects. Greatest effort was devoted to warm-water fish, with trout and salmon following in that order. Marine studies were involved in 8 percent of the projects. The aquatic habitat—streams, ponds, natural lakes, impoundments, and marine waters—was investigated extensively.

While investigations involving a variety of habitats and species of fish cover a wide range of subjects, a trend toward certain types of activities was apparent in the past year. The principal emphasis was on inventories to determine fish-population characteristics and angling success. Of the total investigational effort, 35 percent was devoted to these objectives; experimental management and evaluation studies accounted for 28 percent. The continued emphasis on these activities reflects the results of studies of preceding years and indicates the greater application of findings. During the year, 109 publications resulted from investigational projects.

Fish-restoration development projects were responsible for the construction of 37 lakes which will create almost 6,000 acres of public fishing water. Twenty-six States and Alaska improved fisherman-access facilities by providing roads, trails, parking areas, launching ramps, sanitary facilities, potable water, docks, and signs of various types.

Reclamation of waters, by removing undesirable fishes, was completed in 99 lakes having 10,417 surface acres. In addition, seven States conducted reclamation work on streams.

Related activities included construction of administrative buildings, roads, utility lines, fences, fish screens, firebreaks, watershed protection, and lake and stream improvement devices.

Acquisition of land for various fish-restoration needs continued with 16 States acquiring 2,979 acres and leasing 57,233 acres.

PREDATOR AND RODENT CONTROL ACTIVITIES

During the year the Fish and Wildlife Service continued its long-established cooperative program with agriculture and industry, for application of approved methods of reducing property losses caused by wildlife. Intensified effort was devoted to the field evaluation of new rodenticides, repellent chemicals, and scarce devices. The findings from these studies contributed to the development of a number of improved techniques for better management of certain wildlife populations.

Field personnel in Western States again concentrated on the protection of livestock, poultry, and game from depredations by predatory animals, such as coyotes and bobcats. Hazards associated with lethal devices for destroying such predators were further reduced in many areas by placing plastic warning signs adjacent to "coyote-getters," by using lighter propellant charges in coyote-getter shells, and by curtailing use of lethal devices in areas frequented by the public. The increase in human population in many parts of the West necessitated greater reliance on steel traps—a more costly and less efficient control method.

Predator populations increased in many localities. The ability of these animals to live in close proximity to human habitation was particularly apparent in Los Angeles County, Calif. During December 1956 a Service hunter stationed in the area removed 21 coyotes from suburban communities. Many of the animals were living in areas adjacent to heavily traveled parkways, and several were trapped on the property of a large motion-picture studio. Comparable conditions prevailed throughout sections of the Midwest where human activity in rural areas precluded the use of lethal materials for the protection of small bands of sheep in farm pastures . The situation has become acute in portions of Oklahoma, and officials at the A. and M. College now consider predation by coyotes the major deterrent to successful sheep production in that State.

Considerable effort was devoted to the control of domestic rats and mice, field rodents, rabbits, and other small mammals that had become destructive. The work included large-scale field testing of two new anticoagulant rodenticides, PMP and diphacinone. In addition, there was extensive operational use of warfarin, pival, and fumarin in the clean grain program, especially throughout the Dakotas. The effectiveness of these chemicals has made possible a marked reduction in rat losses; however, contamination of products by mice is a matter of growing concern to the grain-handling industry.

Reports from the Pacific Northwest and Gulf Coast States indicated an upswing in damage by rabbits. Upwards of 195,000 pine seedlings in a Mississippi forest nursery were destroyed by these animals during the past winter. In another instance, only 6 seedlings survived rabbit damage on one 20-acre field where a total of 100,000 trees had been planted the previous year. Rabbits have been similarly destructive on tree farms in western Washington. In addition to damage by various native animals, the South also reported losses of rice, sugarcane, and aquatic duck food due to nutria. These South American rodents are valuable as furbearers, but their introduction into agricultural areas has resulted in instances of severe damage to crops and water-control structures.

Field personnel participated in testing an endrin-arasan repellent on tree and watermelon seeds. The chemical formulation proved useful in preventing damage by several species of seed-eating mice. Sublethal amounts of endrin-coated seeds tend to make the animals ill but do not kill them. The rodents are thus "educated" that such seeds are not desirable as food material.

The high postwar incidence of rabies in wildlife continued, and Service personnel in many sections of the country assisted county officials in carrying out control measures. Outbreaks of rabies in foxes were particularly severe in Virginia, Louisiana, Alabama, Georgia, and Texas. In these areas, trapping projects were undertaken to reduce local fox populations and curtail spread of the disease.

Field operations in Alaska were concentrated on a study to obtain more information on wolf-caribou relations. Many instances of predation of big-game animals were noted during the year. In southeast Alaska, Service personnel sighted a pack of five wolves which were taken after they had killed no less than nine deer during a 2-day period. In the Tanana River area, upwards of 170 moose kills due to predation by wolves were noted. Service hunters destroyed 18 of the wolves in 1 day through the use of aircraft.

Cooperative predator and rodent control operations during the fiscal year 1957 entailed expenditures of $1,757,796 from regular departmental appropriations, supplemented by $1,462,435 from cooperating States and $1,366,481 from cooperating counties, livestock associations, and others. The recorded catch of predatory animals by Bureau and cooperative personnel was 62,585 coyotes, 2,790 wolves, 22,198 bobcats and lynx, 1,039 stock-killing bears, and 267 mountain lions. In rodent-control operations, 9,800,212 acres of land were treated for elimination of prairie dogs, ground squirrels, pocket gophers, jackrabbits, field mice, cotton rats, kangaroo rats, porcupines, woodchucks, and moles. In addition, 548,038 premises were treated in cooperative campaigns for the control of rats. Special equipment and supplies used in both predator and rodent control, and 336,470 pounds of rodent-bait materials, were distributed by the Service's supply depot at Pocatello, Idaho.

RIVER BASIN STUDIES

The Fish and Wildlife Service issued 340 reports this year on the fish and wildlife aspects of water-development projects planned, cost-shared, or licensed by the Federal Government. Of these, 135 were projects of the Corps of Engineers and 30 were projects of the Bureau of Reclamation. Reports on locally sponsored projects which are only cost-shared by the Federal Government included 102 on small watershed projects assisted by the Soil Conservation Service and 8 on the small reclamation projects which receive assistance through the Department of the Interior. There were 65 reports on power projects requiring license from the Federal Power Commission, and 24 reports on special and miscellaneous subjects.

In line with the Coordination Act of 1946, plans were completed between construction and State conservation agencies for use of 11 water-use projects by the State agencies for wildlife management. These include the Bonnet Carre Spillway area in Louisiana and lands at the following reservoirs: Bayou Bodcau in Louisiana, Boysen and Keyhole in Wyoming, Denison in Oklahoma, Indian Rock in Pennsylvania, Lucky Peak in Idaho, San Angelo and Texarkana in Texas, Tiber in Montana, and Webster in Kansas.

An interim report was prepared on the proposed Bruces Eddy project in Idaho. Studies thus far indicate that the project would result in the loss of about 40 percent of the elk and 60 percent of the deer using the range to be affected. Before an estimate of the effect of the high dam on fishery resources can be evaluated, more data are needed on present fish populations, harvest, distribution of spawning gravels for anadromous fish, and other characteristics of the fishery and its habitat requirements.

A proposed partnership project of the Nebraska Mid-State Reclamation District provides for integration of fish and wildlife conservation in its plan for development of irrigation, power, and municipal water storage along the Platte River. The report on this project points out modifications in the original plan which would result in additional fish and wildlife and recreational benefits.

A report on fish and wildlife of the proposed Garrison diversion project in North and South Dakota was completed and coordinated with the Bureau of Reclamation's engineering plans. The fish and wildlife report assesses the effects of the project on these resources and certain Federal waterfowl refuges. The development of 62 fish and wildlife areas is expected to compensate largely for waterfowl habitat which would be lost and also provide benefits to fish and other wildlife. These plans are incorporated in the project plan approved by the Secretary of the Interior.

The solution to critical problems associated with water-use developments involving anadromous fishes (salmon, steelhead trout, striped bass, and shad) have required the combined efforts of several Service branches.

The Snake River, one of the largest salmon-producing tributaries of the Columbia River, was the scene of much activity. During the past year, the Department recommended that fish-passage facilities be installed at the Idaho Power Co. dams—the Brownlee, Oxbow, and Hells Canyon dams in Idaho and Oregon. General plans for a downstream fish-collection system were recommended to the Federal Power Commission in order to meet construction schedules at Brownlee Dam. Fish-passage devices will be required also at Ice Harbor Dam, now under construction near the mouth of the Snake River.

Priest Rapids and Rocky Reach Dams on the main stem of the Columbia River in Washington and Pelton Dam on the Deschutes River in Oregon are under construction. Other dams scheduled for early construction on tributary streams are the Swift project on the Lewis River in Washington and the North Fork Dam on the Clackamas River in Oregon. Fish and Wildlife Service technicians are working out ways to preserve runs of salmon and steelhead at these projects. At Savage Rapids Dam on the Rogue River in Oregon, detailed plans were developed for installing screens to prevent the loss of young seaward migrants. To prevent losses of anadromous fish in connection with construction of dams on the Trinity River in California, a fish hatchery will be built by the Bureau of Reclamation.

The Department, on the basis of findings of the Fish and Wildlife Service, advised the Federal Power Commission that it does not recommend the issuance of a permit for the proposed Wood Canyon Dam on the Copper River in Alaska in view of the difficult problems of salmon passage involved. To increase the dissolved-oxygen content of the water in the Roanoke River below Roanoke Rapids Dam in North Carolina, construction of a submerged weir surrounding the intakes of the turbines has been initiated by the licensee. Federal and State conservation agencies plan to study the effectiveness of this weir in improving the stream for striped bass.

Studies are being continued at Narragansett Bay in Rhode Island to determine the effect on shellfish and finfish of hurricane-control barriers proposed by the Corps of Engineers.

The Service submitted its first two detailed reports to the Soil Conservation Service concerning small watershed projects. They are Ten Mile Creek in Minnesota and Toogoodoo Creek in South Carolina. Both reports recommended measures to mitigate fish and wildlife losses, and these recommendations are being considered by the Soil Conservation Service in the revision of original plans. Of 172 reconnaissance reports submitted by the Fish and Wildlife Service to date on these locally sponsored projects, 7 indicated that fish and wildlife losses would be great enough to warrant detailed studies by the Service.

Prospects for preservation of privately owned marshes, potholes, and other wet areas look less gloomy today than during the past several years. Restrictions imposed by the Department of Agriculture on drainage assistance rendered to farmers have helped reduce some losses of aquatic habitat. There also appears to be a greater public awareness, particularly on the part of private conservation organizations, that wetland drainage should be curtailed during these times of agricultural crop surpluses. Congress also has shown interest in investigating the need for federally assisted drainage at this time.

BUREAU OF COMMERCIAL FISHERIES

Donald L. McKernan, *Director*

COMMERCIAL FISHERIES

THE Fish and Wildlife Service's responsibility to the welfare of the fishing industry is being met by exploratory, technological, market-development, economics, statistics, and market-news programs to aid in the preservation and proper utilization of fishery resources.

With the passage of the Fish and Wildlife Act of 1956, the Saltonstall-Kennedy Act was made permanent. Each fiscal year an amount equal to 30 percent of customs duties collected on imported fishery products is made available for various types of fishery research and services to develop and increase markets for domestic fishery products.

The 10-million-dollar fisheries-loan program, authorized by the Fish and Wildlife Act of 1956, is in operation. Loans are for financing and refinancing of operations, maintenance, replacement, repair, and equipment of fishing gear and vessels, and for research into the basic problems of fisheries.

The technological fishery research program, oriented to the solution of industry problems, has been extended by contract research at 32 of the Nation's leading research centers. Fundamental research is conducted in the broad fields of improved utilization, quality and processing studies, standardization, and nutrition and radiation preservation of fishery products. Results are made available to the industry through consulting services, publications, and plant visits and demonstrations. Some outstanding results of the coordinated basic research include development of a technique for retaining desirable pink coloration of canned tuna and the use of menhaden oil in leather processing. Applied research is exemplified by progress in the development of voluntary United States standards for fishery products. Standards for frozen fried fish sticks became effective last year, and several other standards are in the process of development or promulgation. Seven fish-processing plants now have continuous inspection service.

Commercial utilization on a small scale of deep-water royal-red shrimp off the southeastern States and tuna from the Gulf of Mexico is reported. These resources were discovered in earlier explorations by the exploratory vessel *Oregon*. As a result of exploratory fishing and gear studies by the *John N. Cobb*, a new shrimp fishery is being exploited off the Washington coast. Exploratory long-line fishing by the *Delaware* in North Atlantic offshore waters indicates the availability of tuna of several species north of their known winter ranges and points out a new pelagic resource of potential value. An inexpensive and simple electrical telemeter has been designed and constructed to measure the exact fishing depth of nets—an important step in the development of practical midwater trawls.

Regulatory activities and reports on fishery cooperative marketing associations are continued in accordance with the authority of the Fishery Cooperative Marketing Act of 1934. On June 30, 1957, there were 81 active fishery cooperative marketing associations in the United States and Alaska.

Transportation rate increases and problems and their effect on the fishing industry are studied. The problem of imports of ground-fish fillets and tuna is under constant study. Final reports are in preparation on fish marketing and consumption in the Pacific Coast States, on an economic survey of the domestic shrimp industry, and on a survey of fishing vessel hull and personal and indemnity insurance. A report on household consumer preferences for canned fishery products reveals information on markets. Three new studies are in progress: (1) a study of the interaction of biological and economic forces in the fisheries; (2) a study of the effects of controlled production and marketing conditions on the halibut fishery; and (3) a study of the factors which affect prices for key fishery products such as canned salmon and fresh oysters.

Service home economists gave 244 fish-cookery demonstrations for school lunchroom personnel, extension agents, home-economics classes, and institutional groups. Special market-promotion campaigns on fresh fish were conducted in three cities as well as a national industry-Government cooperative campaign for canned tuna and for "National Fish Parade."

Two market-development motion pictures were finished and placed in distribution. An award was given the Department by the British Government in recognition of the Service-produced industry-financed film "Outboard Fisherman USA." Sales of over 60,000 copies in less than 5 months were reported for the full-color recipe booklet "Shrimp Tips from New Orleans."

A program to find markets for certain underutilized fish in Lake Erie is showing results with the marketing of a large harvest of sheepshead to fur-animal farms and pet-food manufacturers. A market has been opened in the Midwest for the cocktail shrimp of Alaska. New markets for Pacific Coast Dungeness crabs have been developed in Florida.

To aid in the orderly marketing of fishery products and byproducts, marketing specialists in fishing and distribution centers collect daily marketing information. Timely information is disseminated through daily reports by the seven Fishery Market News Service field offices, in Boston, New York City, Hampton, New Orleans, San Pedro, Seattle, and Chicago. These reports are used extensively in the fishery industries, conservation work, granting loans, supplying background data for governmental actions, research, and determining the economic importance of the fisheries. Expansion of market news coverage for frozen and canned fishery products has been initiated. The first of a series of reports on the status of segments of the fisheries was issued.

The monthly periodical, Commercial Fisheries Review, continued to feature articles and news of trends and developments in the fishery industries of the United States and foreign countries.

General statistical surveys of the fisheries for 1955 were completed for all sections of the United States. Similar surveys for 1956 were undertaken. Monthly bulletins on landings of fish and shellfish in 12 coastal States and Ohio are published. Detailed data are collected on Maine and Massachusetts landings by individual vessels, area of capture, etc., and on the shrimp fishery of the Gulf of Mexico and the South Atlantic States. Detailed economic and biological statistical tabulations are released periodically.

Monthly bulletins are released on domestic freezings and holdings of fishery products, the production of fish meal and oil, and United States foreign trade in fishery products. Quarterly reports on the yield of fish sticks and annual bulletins on the production of canned fishery products, byproducts, and packaged fish also are released.

RESEARCH IN FISHERY BIOLOGY

Coastal Fisheries

The Service, as research agency of the Atlantic States Marine Fisheries Commission, continued its investigations of Atlantic-coast shad fisheries to determine causes of declines and conditions favoring recovery.

In the Connecticut River, research has shown that shad production depends on permitting a sufficient number of fish to spawn. From previous work on the river, Service biologists can predict the size of the shad run a year in advance so fishing regulations can be set to provide for a proper escapement of spawners.

In the Hudson River, as a result of a decrease in shad fishing since 1950 with consequent increase in escapement of spawners, the shad run is nearing its former high level. A run of almost 6 million pounds was predicted for 1957. In 1956 the run was about 4.1 million pounds and the commercial catch was about 1.8 million pounds; in 1950 the run was about 1.4 million pounds and the commercial catch was just short of a million pounds.

On the Delaware River, the depletion of shad was caused primarily by pollution in the Philadelphia-Camden area. Although some antipollution action has been taken, the river is still too polluted for restoration of the fisheries.

Research continued on the striped bass of Albemarle Sound and the Roanoke River, with a large-scale tagging program to determine annual populations in relation to spawning conditions.

In February 1957 the Service and the States of Virginia and Maryland began an investigation to determine what percentage of striped bass spawned and reared in Chesapeake Bay take part in the northern coastal migration, and to measure the exploitation of Chesapeake Bay stocks by sport and commercial fisheries inside and outside the bay.

In cooperation with the State of Maine, research continued on the Atlantic Salmon in Sheepscot River.

Electrical methods of counting fish were also advanced through improvements in instruments and through field experience. Progress was made also in engineering research on electrical guiding of fish, on the nature of the electrical fields, and on prediction of power demand of different electrode arrangements. Projects have been started to use electric fish counters for large numbers of fish. Continued studies of sonic tags for fish showed that adult salmon carrying the sonic tags can be tracked for periods up to 8 hours.

Reactions of over 10,000 adult salmon and steelheads were measured at the Fisheries-Engineering Research Facility at Bonneville Dam during 1956 to find more economical methods of providing safe passage for the fish.

Above Rock Island Dam on the Wenatchee River system, progress was made on studies by the proposed Chelan County Public Utility District hydroelectric power project. Fishery research was directed toward ascertaining the magnitude, the timing and spawning areas of anadromous fish runs into the system, and the timing of the downstream migration of the young fish. Surveys in the summer of 1956 on all the tributaries and the main stem of this system showed the spawning areas utilized by salmon in relation to the areas to be inundated by the impounded waters. Water-quality data were collected from five stations on the Columbia River and six stations on the Wenatchee River system.

To determine production of young salmon from a specific year's spawning run, a trapping station was established at the Prosser canal bypass at Prosser, Wash., and a daily and seasonal trend of migrating fingerlings was established by operating the trap 24 hours daily. The Columbia River blueback-survival studies showed that most of the bluebacks spawn on the Okanogan and Wenatchee River systems in Washington and at Redfish Lake in Idaho. A 10-year fingerling migration study at Bonneville Dam ended during the year. At bypass traps, information was collected on species, age and size, and migration, time of migration, numbers of marked fish, and identity of marks.

The Milford Laboratory and the State of Connecticut Department of Shellfisheries established oyster-spawning beds at the mouths of several rivers and will keep them under observation. The laboratory also worked with the Oyster Institute of North America to develop methods for using salt-water ponds for shellfish culture. The hardiness of the strain of the European oyster, *Ostrea edulis*, bred at Milford was demonstrated.

Experiments in Chesapeake Bay to control oyster drills were effective enough to assure production of seed oysters. In Chincoteague Bay, trapping the drills was effective. Field trials confirmed laboratory findings that copper fencing will repel drills.

In New England, all phases of the life of green crabs have been under study to determine the cause of their increase and to find methods of control. Increase in predation by green crabs was largely responsible for the decrease in the abundance of soft clams north of Cape Cod in recent years.

Experiments with oyster-raft culture were carried out at Oyster River in Massachusetts. Studies consisted in recording the rate of growth and mortality of oysters kept above the sea bottom away from predators and determining the principal ecological factors affecting them.

Studies continued on measurements of accumulated radioactivity from uptake of fission products by fission organisms, the nature of the radio activity accumulated in various parts of the body, and levels

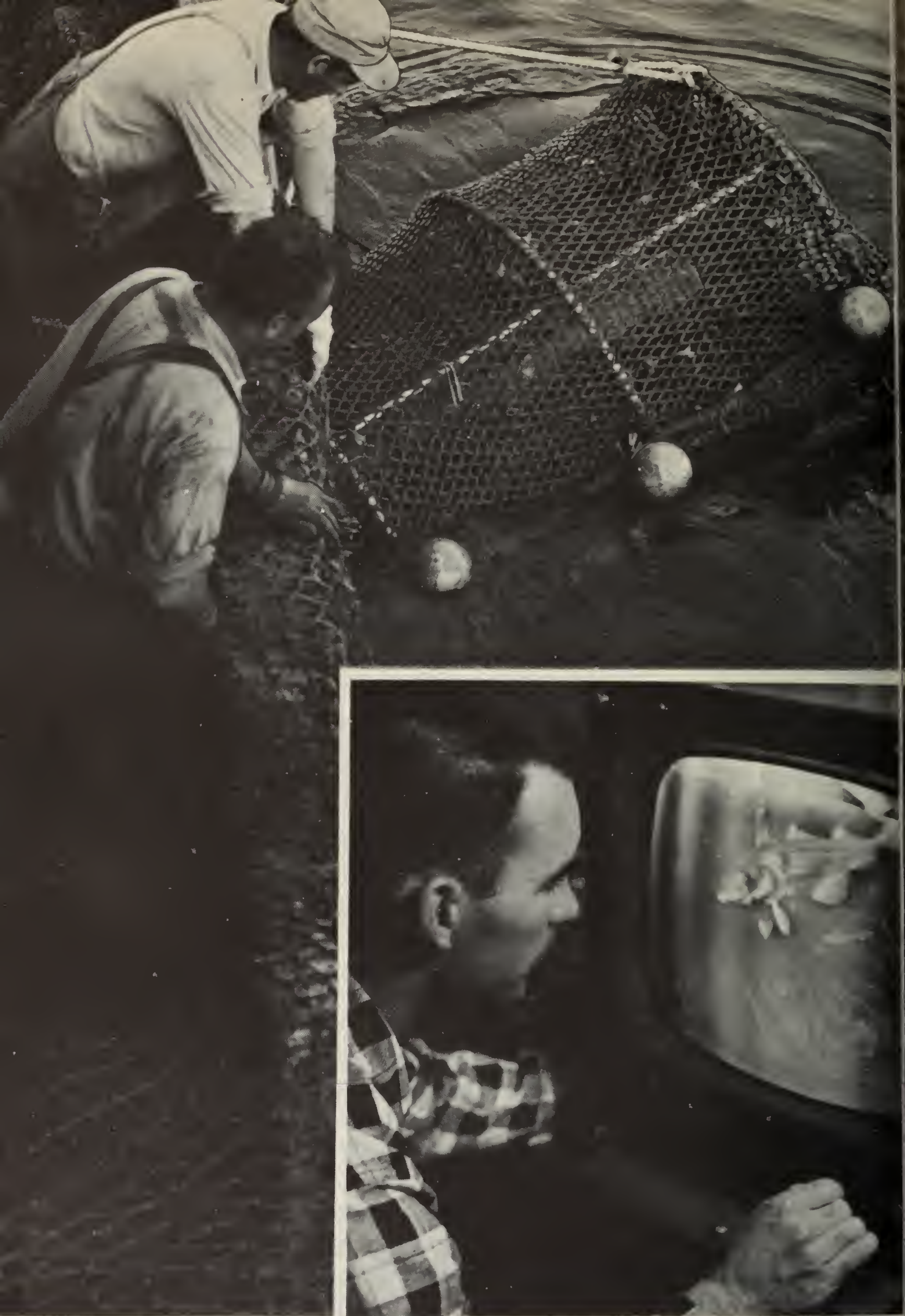


FIGURE 36.—A fish's reaction to fishing gear can be seen through miracle of underwater television. These studies have led to prescribed mesh size of net to conserve small fish by permitting their escape during normal fishing operations.

that could be passed to man through use of seafoods or other marine products. Studies of the biology of plankton and shellfish by means of radioisotopes as tracers have been undertaken. Research along this line centered on planktonic food organisms and feeding mechanisms of shellfish.

Inland Fisheries

The Microbiological Laboratory, Leetown, W. Va., serves the eastern United States as a center of research on the nature, treatment, and prevention of infectious diseases of fish, and as an advisory center for Federal, State, and private hatcheries. From the economic standpoint its most important project is research on kidney disease which is scattered in trout and salmon hatcheries all over the United States and is still spreading. Tests on experimental fish and losses occurring in hatcheries show the high mortality of fish infected with this slow-spreading disease. The Western Fish Disease Laboratory at Seattle, Wash., is expanding its study by cooperating with Oregon, Idaho, and Washington fishery groups and the International North Pacific Fisheries Commission to determine sources of infections in fish.

Experiments were completed at the Willard Laboratory, Cook, Wash., on the quantitative vitamin requirements of chinook salmon, and a cooperative research program was started with the State of Washington Department of Fisheries to test the qualitative vitamin requirements of sockeye salmon. Feeding trials at the Entiat, Wash., laboratory demonstrated that an effectively bound diet increases utilization by 100 percent. Tests showed that a reduction in normal light exposure can accelerate maturation of sockeye salmon.

Sea-lamprey control was confined to Lakes Superior and Michigan with the exception of an experimental barrier on Lake Huron. Research was directed at testing specific larvicides and operating direct-current electrical diversion devices. After many experiments with thousands of compounds over the past several years, two chemicals were selected as most effective. Installation and operation of seven experimental direct-current devices in combination with alternating-current control barriers in Lake Superior problem streams reduced fish mortality from 85 percent to 8.5 percent.

The research vessel *Cisco* made a hydrographic and fishery survey of Saginaw Bay and southern Lake Huron during the summer. The *Cisco* also surveyed Lake Erie to learn the distribution and relative abundance of various species of noncommercial and commercial fish in different areas and at different times of the year. Commercial landings at various ports on Lake Erie were sampled and an inquiry into the age, size, and year-class composition of the walleye and blue pike continued.

Marine Fisheries

Much of the research program in the North Atlantic was developed in collaboration with the International Commission for the Northwest Atlantic Fisheries through its Committee on Research and Statistics. Studies of cod, haddock, ocean perch, and halibut were continued on several of the fishing banks. Underwater television was demonstrated to be a practical research tool, in studying the capture, behavior, and escapement of fish through trawl meshes.

Ocean perch were successfully tagged for the first time in history at Eastport, Maine; 3,385 were tagged from the end of July to mid-November 1956. Recaptures are beginning to yield data on age, growth, migration, and mortality.

Investigations into the life history and biology of the Atlantic menhaden continued, to determine changes within populations and their effect on the fishery.

Methods have been devised for tracing movements of young shrimp. One is feeding the shrimp chopped fish stained with dyes; another is immersing the shrimp in a dilute solution of riboflavin or feeding shrimp with mullet soaked in riboflavin, thus producing luminescence. The staining method is being tested in field holding tanks before commencing trial releases.

From the association of "red tide" with climatic and hydrographical conditions it appears that accurate red-tide forecasting may depend on accurate long-range weather predictions. Work with chemically defined media to establish the nutritional requirements of the red-tide organism was continued.

As an aid to understanding the distribution abundance of Pacific sardine populations, several ecologically associated species are being investigated. Studies at Stanford, Calif., continued on relations between climatic and ocean conditions and sudden fluctuations in major commercial fish stocks on the customary fishing grounds.

The count of gray whales at Point Loma, Calif., during their annual southward migration was the highest since the census was instituted; 1,782 whales were counted.

Biological and exploratory research on Pacific tuna resources continued, with investigations of skipjack in the Marquesas area and in Hawaiian waters, and of albacore in the eastern North Pacific.

In August and September 1956 the Service participated in Operation EQUAPAC, an oceanographic survey of the central and western equatorial Pacific by Japan, the United States, and France.

Participation in the International Geophysical Year began in June 1957, with occupation of an oceanographic station off the Hawaiian Islands.

CONSERVATION OF ALASKA COMMERCIAL FISHERIES

Statistics of the Fishery

In 1956, products of the Alaska fishing industry, including fur-seal byproducts, totaled 226,357,141 pounds with a wholesale value of $92,960,379, as compared with a total of 186,159,932 pounds valued at $69,722,887 in 1955. Salmon increased from 131,280,885 pounds valued at $60,617,136 in 1955 to 160,569,980 pounds valued at $81,955,083 in 1956; herring increased from 23,025,111 pounds valued at $1,531,354 in 1955 to 32,721,689 pounds valued at $2,262,660 in 1956.

Considered by regions, the principal increases were in herring production in Southeastern Alaska and salmon production in Western Alaska, where an excellent run of red salmon developed in the Naknek-Kvichak district of Bristol Bay. This run was of such magnitude that for the first time since the 1930's the canneries had to put the fishermen on limits.

Figure 37.—With private, State and other Federal agencies cooperating, 1,850,000 pounds of game fish were planted from fish cultural stations of the United States Fish and Wildlife Service during 1956. Wilderness area waters in Alaska are regularly planted with airlift fish.

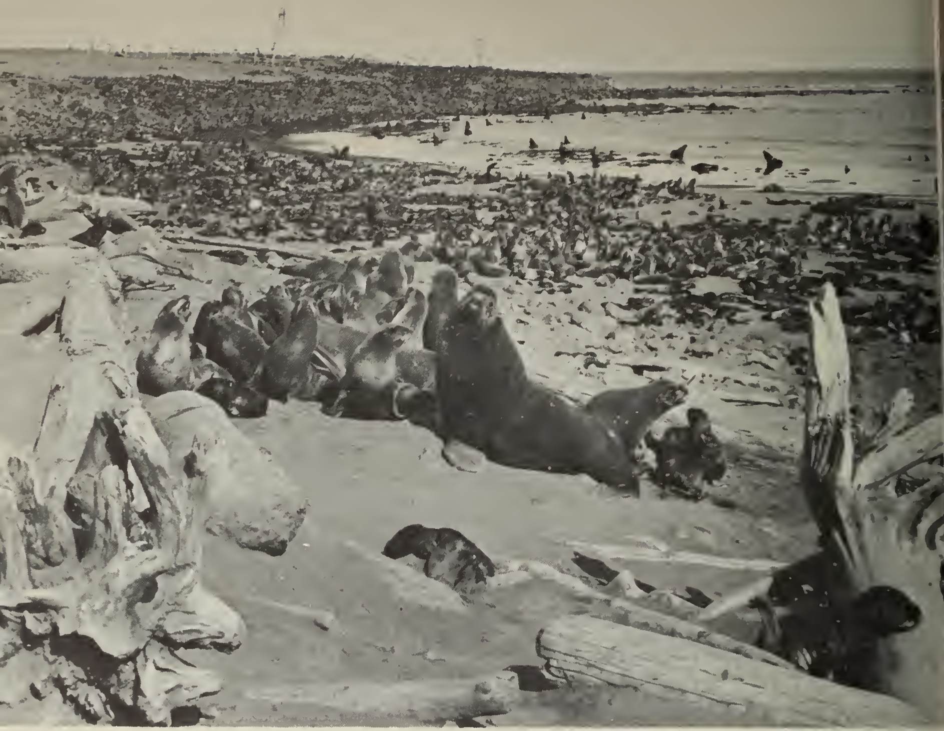


Figure 38.—Treaties between Canada, Japan, Russia, and the United States for the protection of fur seals and management providing for a systematic harvest that has insured a sustained yield have contributed an outstanding chapter to American conservation. The average annual harvest of 65,000 seals has been valued at approximately $6 million.

There were 23,598 persons engaged in the fisheries of Alaska in 1956, of which 12,507 were fishermen, 1,510 were transporters, and 9,581 were shoresmen, operating out of 168 wholesaling and manufacturing establishments. Gear used in taking salmon included 1,136 purse seines, 256 beach seines, 8,072 gill nets, 238 traps, 22,369 troll hooks, and 8 fish wheels.

In administering the commercial-fishing laws and regulations in Alaska in 1956, the Fish and Wildlife Service employed a total of 295 temporary streamguards in addition to permanent personnel.

Research

Research was moved from the Seattle Laboratory to Juneau during 1956, and the staff was considerably augmented. New research projects initiated during 1956 included study on the development of a method of recording escapement of salmon in small streams, research on the effects of logging on the productivity of pink-salmon streams, a study of sea lions and hair seals in Central and Western Alaska, and enumeration of migrant fingerling red salmon in the Egegik and Naknek Rivers in Bristol Bay, in addition to regular research work.

PRIBILOF ISLANDS FUR-SEAL INDUSTRY

Sealing operations on the Pribilof Islands, Alaska, during 1956 produced 122,826 sealskins compared with 65,638 taken in 1955. The increased kill was made to begin the elimination of excess animals from the herd. As in other recent years, the take was divided in accordance with the Provisional Fur-Seal Agreement of 1942 between the United States and Canada whereby 20 percent of the skins are delivered to the Government of Canada. Production on the islands also included 626.1 tons of fur-seal meal and 88,277 gallons of oil. The meal and oil were sold later by competitive bidding for a gross total of $105,229.

During fiscal year 1957, the following quantities of United States Government-owned fur-seal skins were sold at public auction in St. Louis, Mo.: On October 5, 1956, 26,890 skins were sold for $2,687,703, and on April 12, 1957, bidders paid $2,521,710 for 27,819 skins.

FOREIGN ACTIVITIES

During the past year the international fishery commissions of which the United States is a member and in whose work the Fish and Wildlife Service has a direct interest continued to make progress.

Under a modified regulatory system and an expanded investigatory program, the Halibut Commission has been able to maintain the catch at high levels. The catch during the 1956 season was 67 million pounds, which is well above the average for the past 5 years.

In September 1956 the Governments of Canada and the United States signed a Protocol to the Convention on Sockeye Salmon of the Fraser River System, bringing the pink salmon of that river under the jurisdiction of the Sockeye Salmon Commission. Improved management of the pink-salmon resource is expected from this action.

The joint Japanese-Canadian-United States research program being carried out under the auspices of the International North Pacific Fisheries Commission has made gratifying advances, with major discoveries regarding the distribution and migration of North Pacific salmon.

Mesh regulations for the haddock fishery adopted by the International Commission for the Northwest Atlantic Fisheries in 1953 have demonstrated their effectiveness by producing an increase of at least 30 percent in the yield of the 1952 year class in its first 3 years in the fishery.

In its first year, the Great Lakes Fishery Commission has continued and improved upon the lamprey-control programs previously conducted by the Governments of Canada and the United States, and has begun the formulation of a comprehensive program of research on fishery problems in the Great Lakes.

The investigations of the Inter-American Tropical Tuna Commission have made possible an understanding of the fundamental dynamics of the populations which support the United States tuna industry, and have provided a basis for an estimate of the potential maximum sustainable yield of the resource.

In February 1957 the Governments of Canada, Japan, the U. S. S. R., and the United States signed an Interim Convention on the Conservation of the North Pacific Fur Seals. The convention, which awaited ratification at the end of the fiscal year, would make possible cooperation between the four nations bordering on the North Pacific Ocean in the conservation of this valuable resource.

The Service continued to assist the International Cooperation Administration in carrying out the foreign-aid program. During the past year, fishery development programs were carried on in Peru, Liberia, Pakistan, India, Indonesia, Thailand, Vietnam, Taiwan, and Korea. A number of foreign students and administrators received instructions in the United States in various phases of biological science and management of fishery resources.

Office of the Administrative Assistant Secretary

D. Otis Beasley, *Administrative Assistant Secretary*

DEPARTMENTWIDE administrative management responsibilities of the Secretary are executed by the Administrative Assistant Secretary. In performing this function the Administrative Assistant Secretary directs and supervises seven secretarial divisions. These are administrative services; budget and finance; inspection; management research; personnel management; property management; and security.

Following is a record of each division's activities during the past year:

Division of Administrative Services

Floyd E. Dotson, *Director*

Activities of the Division during fiscal year 1957 were concentrated in the performance of housekeeping and basic operating functions for the Office of the Secretary, other Departmental units, and the Commission of Fine Arts. The Division also provided a wide variety of centralized services to other Interior bureaus and offices in Washington and the field. Performance figures for each major function of the Division are given below.

Library Services.—Use of library facilities continued upward. Some 37,476 reading room patrons, 22,101 telephone calls, 101,917 items circulated, 9,932 interlibrary loans, and 18,202 reference inquiries represent an average increase of 20 percent over 1956.

Fiscal Services.—The Office of the Secretary, other Departmental units, the Commission of Fine Arts, and the President's Council on Youth Fitness were provided with normal accounting services during the year. Expenditures for these offices totaled about $7 million. Operations financed under the reimbursable working capital fund amounted to more than $1,400,000. Approximately 1,000 employees were supplied with payrolling services. Accounting control, including budgeting and reporting, was maintained over the approximately $3,500,000 of new funds transferred from other agencies for use by various bureaus of the Department.

Records Management.—Records holdings within the Office of the Secretary were reviewed, and approximately 450 cubic feet of obsolete material was destroyed. Seventy file cases were cleared out for reuse. The official personnel records on all employees and officials under Secretarial appointive authority were transferred from the Central Files Section to the Branch of Personnel Operations.

Personnel Operations.—During the year particular emphasis was placed on recruitment and placement problems, and previous procedures were simplified so that individual offices are now kept better informed on current developments. Normal personnel services were maintained for the Office of the Secretary and other Departmental units.

Museum.—More than 46,000 people, from all States and from 52 foreign countries visited the Department Museum. Educational and historical motion pictures were especially popular, with more than 20,000 viewers, a 100 percent increase over 1956. Normal exhibit preparation and maintenance continued throughout the year.

Central Services.—Statistics for 1957 show 20,000 duplicating requisitions, 15,000 photographic jobs, 7,500 requisitions for stock supplies, 5,300 dispensary treatments, 3,200 telephone changes, and 3,200 printing and binding requisitions, and 2,800 procurement actions.

Division of Budget and Finance

Sidney D. Larson, *Director*

The Division of Budget and Finance is responsible for staff supervision of the budget and financial activities of the Department and represents the Department in these fields in liaison with the Bureau of the Budget, other Federal agencies, and appropriation committees of Congress.

Appropriations made to the Department for the fiscal year ending June 30, 1957, totaled approximately $537 million, of which $223 million was appropriated to the Bureau of Reclamation and the power marketing agencies and $314 million to the other bureaus of the Department.

The Division continued its review of the Department's budget structure in the interest of synchronizing organization structures, budgets and accounting systems. It continued work on improving the budget justifications submitted to the Bureau of the Budget and the Congress to make them concise, easily understood and, at the same time, fully reflect the need for the funds requested. In addition, the staff engaged in a continuous review of the programs of the bureaus aimed at reducing obligations and expenditures.

The Division participated in the joint program of the Bureau of the Budget, Treasury Department, and General Accounting Office for improving accounting and fiscal reporting. A program scheduling future improvement of financial management within the Department was transmitted to the Bureau of the Budget. Assistance was given to the National Park Service in the installation of a modern accounting system in the various fiscal offices of the Service. Review was made of the accounting systems of the Government of the Virgin Islands and the Trust Territory of the Pacific Islands. Continued assistance was provided other bureaus of the Department in accounting systems improvement and other fiscal matters.

The Division continued to cooperate with the General Accounting Office and with the bureaus of the Department in the comprehensive audit program and provided the leadership for correcting deficiencies in fiscal and other matters set forth in the audit reports.

Division of Inspection

W. Darlington Denit, *Director*

The Division of Inspection is responsible for the inspection and investigative activities of the Department. Major responsibility for actual inspection performance is placed in the bureaus of the Department. During the past fiscal year there has been measurable progress in the development of inspection programs in the bureaus. The most notable areas of progress in the inspection activity have been the development of field inspection at area and regional office levels and the diversity of the various functions covered by inspection. Through the media of the inspection program many disclosures of weaknesses in administrative procedures have been made and corrective actions instigated.

The major underlying purpose of the Department's inspection program is to preserve and foster high standards of moral and ethical conduct in the management of the Department's affairs. The increasing momentum of the inspection effort is also providing information which enables the anticipation of regulatory needs and the application of corrective measures.

The investigative phase of the activities of this Division has been sponsored by the Department for many years. This activity extends, in the main, to special investigations of alleged administrative irregularities in the discharge of official duties. Special investigations of other matters within the responsibility of the Department are conducted as authorized by the Administrative Assistant Secretary. Only limited investigative authority has been delegated to the bureaus. The workload in the Branch of Investigations has been especially heavy during this past fiscal year but cases are being handled on a current basis in all respects.

The Government employment policy of nondiscrimination, as provided in Executive Order 10590 and related Department regulations, is being applied on a departmentwide basis. Specific complaints of discrimination have been at a minimum and periodic checks have revealed effective policy compliance in all bureaus.

Division of Management Research

Arthur B. Jebens, *Director*

A prime objective of the Department is to increase the effectiveness of its programs with a minimum of increases in appropriations and employees. The Division of Management Research is responsible for initiating, defining, and coordinating work throughout the Department to accomplish this objective.

The Division cooperated with the Fish and Wildlife Service and the Bureau of the Budget in preparing organization plans for, and negotiating with other agencies for the transfer of functions to, the new Fish and Wildlife Service created by the Fish and Wildlife Act of 1956.

The policy recommendations of the Commission on Intergovernmental Relations were reviewed, and surveys were begun of the Department's grant-in-aid programs; the survey of the Bureau of Mines' anthracite mines drainage program was completed during the fiscal year.

The General Services Administration cooperated with the Division in a departmentwide survey of paperwork management activities to evaluate the present effectiveness of these activities and propose recommendations for their improvement. The Division also developed plans to improve and speed the processing of secretarial mail.

The rapid progress of electronic computation and data processing is making available increasingly versatile equipment; three bureaus of the Department (Mines, Geological Survey, and Bonneville Power Administration) already have computers. The Division of Management Research is responsible for developing and coordinating systematic means for increasing knowledge and exchanging experience about computers. A Manual Release defining computer policies was prepared and a Departmental Automatic Data Processing Committee established.

The following list is a cross section of other Division projects:

1. Revised the Department's Emergency Operations Handbook after a reappraisal of essential wartime functions and attack assumptions.
2. Analyzed the operation of the World War I Federal Explosives Act, resulting in a recommendation for its repeal.
3. Prepared a report on the administration of laws on the withdrawal of public lands for Government use.
4. Assisted the affected bureaus in applying the recommendations of the land appraisal report and in developing training programs for appraisers.
5. Prepared a Manual Release defining the jurisdiction of Interior bureaus on public lands under their control as discriminated from the jurisdiction of State and local governments.
6. Prepared a regulation governing the making of motion pictures and TV productions on Interior lands.
7. Lead a survey team that examined the Bureau of Land Management's timber management in the western Oregon lands.
8. Prepared a report outlining organization and management possibilities for carrying out forestry and associated functions of the Interior and Agriculture Departments.
9. Continued the bimonthly publication of Management Highlights, containing articles on administration and management improvements.

The Division's Branch of Directives Management assisted Bureaus and Offices in developing material for the Departmental Manual, and in administering their internal manual systems; and served as a central clearing point for Federal Register documents.

The Division's Branch of Incentive Awards reported a 56 percent increase in suggestions submitted, and a 45 percent increase in superior performance awards. A $12,000 award was granted for outstanding achievements in the protection of fishery resources.

		Dollar savings
Number of suggestions submitted	4, 524	$2, 482, 095
Superior performance awards	810	765, 558
Special act awards	35	338, 115
Distinguished service awards	45	
Meritorious service awards	129	
Commendable service awards	329	

Division of Personnel Management

Newell B. Terry, *Director*

The recruitment and utilization of professional personnel, principally scientists and engineers, has been of particular concern to the Division of Personnel Management during the past year. Among other activities in this field, a detailed report of the utilization practices of scientific and engineering personnel was made to the Office of Defense Mobilization; and the report was used within the Department as a means of improvement. Special recruitment programs for foresters, engineers, research biologists, physical scientists, and other similar specialists resulted in some improvement in the overall manning for Departmental needs.

Three personnel training conferences were conducted for managers and supervisors as well as personnel specialists. The conferences were held in Portland, Oreg., Denver, Colo., and Washington, D. C. Problems of recruitment, examining, and utilization were stressed under the general topic: "Career Service in the Department of the Interior." A booklet entitled, "Careers in the U. S. Department of the Interior" was published to acquaint college faculties and students with professional employment opportunities in the Department.

The first departmental manager development program for experienced personnel in grades GS–10 through GS–12 was inaugurated. This program supplements the departmental management training program which, for the past 8 years, has trained outstanding young career employees in the lower grades. Twenty-eight trainees successfully completed the latter program during the past year. Eight professional student trainee and promotion programs were inaugurated.

Pay-saving legislation and subsequent regulations of the Civil Service Commission necessitated implementation and a complete review of all positions affected. Progress was made in the development of both classification and qualification standards for positions in the Department.

A number of employee grievances and disputes in the labor relations field were settled through arbitration or by mutual agreement through negotiations with the labor representatives of the employees involved. Close relationships with the national and international headquarters offices of labor unions have been maintained and extended through consultations on fundamental labor relations policy proposals.

Under a broad accident prevention program, there has been a noticeable decrease in work injury frequency rates. A motor vehicle safety program was inaugurated and substantial improvements made in the fire loss prevention program. Over 200 safety committees have been organized within the Department and are working to reduce accidents of all kinds.

At the end of the fiscal year, the Department had 56,005 paid employees.

Division of Property Management

N. O. Wood, Jr., *Director*

An outstanding feature of this Division's activities was the completion of a series of four 1-week procurement and supply conferences at strategic locations throughout the United States. A total registration of 392 bureau procurement and supply specialists attended the conferences. In addition, representatives of the following acted as panel members, lecturers, or otherwise participated: (1) President's Committee on Government Contracts, (2) Bureau of the Budget, (3) General Accounting Office, (4) Small Business Administration, (5) General Services Administration, (6) Associated General Contractors, and (7) Workshop for the Blind. The meetings were of the open-forum type designed to insure maximum participation by bureau representatives.

In the contracting field the Division furnished representation on the task force created to carry out the Presidential directive covering a review of governmental contracting and procurement policy laws and regulations.

Policy and procedure documentation for inclusion in the Departmental Manual was developed for the contracting activity to include chapters on (1) Negotiation of contracts, (2) Nondiscrimination, (3) Escalation, (4) Advance payments, and (5) Small business.

The Division represented the Secretary of the Interior in cooperating with the General Services Administration in the establishment of Government motor pools in nine additional cities.

Action continued in promoting the disposition of major property holdings which are determined to be excess to the Department's program requirements. For example, approval was obtained from the General Services Administration for the transfer of 10,793 acres of land at Fort Wingate, N. Mex., from the Bureau of Indian Affairs to the Department of Agriculture.

In records management, the Division arranged for the training of individuals from three of the bureaus in the technical aspects of forms management; the training was conducted at the Department of the Navy. A complete policy and procedural outline in the field of records management was prepared for the guidance of our bureaus and offices. This outline is documented as a separate series in the Departmental Manual. More than 50,000 cubic feet of inactive and obsolete records were removed from filing cabinets during the fiscal year 1956.

Radio-frequency assignments made to the offices and bureaus totaled 362 for the year; 509 individual station assignments were registered with the International Telecommunication Union. Communication tests were conducted bimonthly in order to maintain the departmental relocation communications center in a state of readiness. Additional personnel were trained for communication duties to replace vacancies and to strengthen the complement of trained personnel available for emergency operations.

Division of Security

J. Cordell Moore, *Director*

During the fiscal year ending June 30, 1957, the Division of Security continued its planning on physical security and civil defense. New regulations covering physical security have been prepared in cooperation with bureaus and offices of the Department. The regulations have been specifically designed to cover the problems arising from the dissimilar functions of the bureaus and offices.

In the civil defense areas, the Department has made contributions of considerable value particularly on the disaster relief program and relocation planning. The disaster relief program under Public Law 875, 81st Congress, might be considered to have passed the planning stage and to have entered the operating stage. The departmental defense liaison officers in the seven civil defense regions have largely completed their initial planning and now have the capability for rendering aid and assistance in case of natural disasters occurring within their region. The types of disasters in which assistance was rendered during fiscal year 1957 included floods, forest fires, and hurricanes. Region III and V, particularly, were called upon and were able to render valuable service in connection with hurricanes and floods which occurred during the year.

The Division participated with other offices of the Department in relocation planning culminating in the annual exercise designed to test the continuity of Government functions.

In the field of personnel security the fiscal year was largely devoted to consolidating and refining techniques and establishing an up-to-date record system. This record system was completed before the end of the fiscal year. A review of sensitive positions has also been started designed to eliminate certain positions from the sensitive category and to add other positions based on the duties of the incumbents. This review has progressed satisfactorily and is scheduled for completion in the first quarter of the 1958 fiscal year.

OFFICE OF THE SOLICITOR

Elmer F. Bennett, *Solicitor*

WORK IN THE Office of the Solicitor during the fiscal year was kept reasonably current. While there were more matters undisposed of at the close of the fiscal year than there were pending at the beginning, approximately 140,000 matters were disposed of during the fiscal year 1957, as compared with approximately 131,000 matters disposed of during the fiscal year 1956.

In March the office of the Field Solicitor which furnished legal services to the National Capital Parks was abolished and the functions of that office were consolidated with those of the Branch of National Parks, Division of Territories, Wildlife and Parks of the headquarters office of the Office of the Solicitor.

To inform the public and to promote uniformity in the application of the Federal Coal Mine Safety Act, a regulation governing appeals of operators to the Director, Bureau of Mines, and a series of interpretations of various provisions of that act, were promulgated as two new subchapters of chapter I, title 30, Code of Federal Regulations.

Twelve patents or inventions developed in the Department's researches and investigations were granted. One of the patents covers the electrical weirs which were installed in a number of streams in the Great Lakes watershed to control sea lampreys. Two others, which have been adopted commercially in the United States and abroad, cover the first successful system of utilizing lignite as an industrial fuel. Another patent covers a well bore caliper now widely used by the petroleum and natural gas industry.

The legislative progress on bills in which this Department is vitally interested proceeded at an easy pace as is usual in the first session of a Congress. However, the number of congressional requests for reports by this Department on legislation introduced during the first session of the 85th Congress substantially exceeded the number of requests received during the first session of the 84th and 83d Congresses as of the close of each fiscal year involved.

There follows a selected list of important cases relating to the activities of this Department decided by or pending in the courts during the fiscal year, of important administrative decisions and of significant opinions of this office. A discussion of cases of especial importance to the Bureau of Reclamation appears in the report of the Commissioner of Reclamation.

United States v. *Louisiana*, Original No. 15 (U. S. Sup. Ct.). A determination of the respective areas of jurisdiction of the United States and the State of Louisiana on the Outer Continental Shelf off the Gulf of Mexico is sought by this suit. Action by the Court in enjoining further leasing and development except by agreement of the parties filed in the Court resulted in an agreement on October 12, 1956, under which development was resumed, and further leasing made possible in the disputed area. As a result of consideration of the motions of the United States for judgment and of Louisiana for leave to take depositions, the Supreme Court said that in its opinion "the issues in this litigation are so related to the possible interests of Texas, and other States situated on the Gulf of Mexico, in the subject matter of this suit, that the just, orderly, and effective determination of such issues requires that they be adjudicated in a proceeding in which all the interested parties are before the Court." The Court then on June 24, 1957, granted leave to each of the States of Alabama, Florida, Mississippi, and Texas to intervene in the suit, with leave to the United States to file an amended or supplemental complaint adding as parties to the suit any of such States that did not intervene.

Arizona v. *California*, Original No. 10 (U. S. Sup. Ct.). This case (which is also noted in the annual report of the Commissioner of Reclamation) involves, among other things, claims to rights in waters of the Colorado River by large numbers of Indian tribes and individual Indians. During the fiscal year the preparation and assembling of evidence of the water claims of 27 Indian reservations in the lower basin of the Colorado River was completed by the technical staff of engineers, hydrologists, soil scientists, and other personnel of the Bureau of Indian Affairs who worked under the supervision of attorneys in this Office on this matter. The resultant evidentiary material was furnished to the Department of Justice for use in the presentation of the Government's case before the special master. It is expected that starting in August 1957, testimony of experts who worked on its preparation as well as the evidentiary material itself will be introduced in the case.

Texas v. *New Mexico*, Original No. 9 (U. S. Sup. Ct.). The Supreme Court on February 25, 1957, dismissed the bill of complaint of the State of Texas, which had sought to require the release of additional water from El Vado Reservoir in New Mexico, because of the absence of the United States as an indispensable party.

United States v. *Union Pacific Railroad Co.* (353 U. S. 112). This was an action brought in the District Court by the United States to enjoin the Union Pacific Railroad Co. from drilling for oil and gas on the right-of-way granted to it by section 2 of the act of July 1, 1862 (12 Stat. 489, 491), for the construction of a railroad and telegraph line. The court held that the grant of the right-of-way through the public lands did not convey to the railroad company the title to oil and gas deposits underlying the right-of-way, and that the railroad company may not remove or dispose of such deposits.

Rosedale Coal Co. v. *Director of the U. S. Bureau of Mines* (No. 7425, U.S. Court of Appeals, 4th Circuit). This decision sustained the actions of the Director, Bureau of Mines, and the Federal Coal Mine Safety Board of Review in classifying the appellant's mine as "gassy," and upheld the methods and procedures of the Bureau of Mines in determining the methane content of mine atmosphere for the purpose of such classification.

Tri-State Construction Co. (64 I. D. 38). A strike precipitated by a contractor's decision to discontinue pay for travel time was foreseeable and hence the appeal to avoid liquidated damages was denied.

Gila Construction Co., Inc. (63 I. D. 378). The Board of Contract Appeals is not authorized to determine an appeal by a contractor in the absence of a finding of fact or decision by the contracting officer, nor to review a determination by the Comptroller General relative to the final settlement of a contract. Information about a contract claim furnished by the contracting officer to the Comptroller General is not a finding of fact or decision within the disputes clause of the contract.

J. D. Armstrong Co., Inc. (63 I. D. 289). Under specifications which called for unclassified excavation, the contractor could expect to encounter a substantial amount of hard material, and, consequently, he was not entitled to an equitable adjustment under the changed conditions article of the contract. Under an approximate quantities provision in the contract the contractor was not entitled to additional compensation by reason of a large overrun in compacted embankment work over the estimated amount of the work indicated in the schedule, when the amount of compaction work actually required conformed to the dimensions and standards prescribed by the drawings and specifications, and the contractor could have computed the amount of compaction work from the drawings before bidding. The contractor has filed a suit in court.

Caribbean Construction Corp. (IBCA–90, June 28, 1957). Claims for additional compensation for the removal of piling, in addition to piling indicated in the drawing and for the laying of a sewer in extremely adverse soil conditions which should not have been encountered by the contractor in an area described as "dredged fill" were allowed under the "changed conditions" and "changes" clauses of the contract.

United States v. *Keith V. O'Leary et al.* (63 I. D. 341). In this case although a hearing had been held on charges brought by the Government against the validity of a mining claim under the then prevailing departmental practice, the hearing had not been held before an officer authorized by the Administrative Procedure Act to preside at hearings. The decision remanded the matter for a rehearing to be conducted in conformity with the requirements of the Administrative Procedure Act on the grounds that administrative proceedings in which hearings are necessary in order to satisfy the requirements of due process must comply with the provisions of that act even though there is no statutory requirement that the validity of mining claims be determined on the record after opportunity for an agency hearing. However, in *United States* v. *Alonzo A. Adams et al.* (64 I. D. 221), it was held that where a contestee does not object to the fact that a hearing officer was not appointed in accordance with the provisions of the Administrative Procedure Act until the case is on appeal to the Secretary, the objection is not timely and does not require that the proceedings be set aside.

Clear Gravel Enterprises, Inc. (64 I. D. 210). Where there are no issues of fact involved and where a claim to public land is null and void on its face and as a matter of law, no hearing is necessary to declare the claim invalid and the provisions of the Administrative Procedure Act do not apply.

Henry Offe (64 I. D. 52). Where a regulation governing the renewal of small tract leases is amended after the issuance of a lease and is not specifically incorporated in the lease, the regulation will be deemed applicable to the lease if it confers a benefit and not an added obligation on the lessee, does not affect the rights of others, and is not detrimental to the interests of the United States.

TECHNICAL REVIEW STAFF

John B. Bennett, *Director*

DURING fiscal year 1957 the Technical Review Staff continued to perform primary staff work in the areas of soil and moisture conservation, watershed protection and flood prevention (P. L. 566), weed control, and related programs. The financial status of the overall soil and moisture conservation program shows that some bureaus have failed to reach the goal set forth in their schedules during this second year of the 20-year period. An attempt is being made to evaluate progress in application and the effectiveness of certain conservation measures. The Technical Review Staff cooperated with the Department of Agriculture in the development of criteria for the national inventory of conservation needs.

The Technical Review Staff has continued to coordinate the review and comments of the Department relative to the watershed protection and flood prevention work plans referred to it by the Department of Agriculture and has assisted in the revision of Agriculture's Watershed Manual as related to the Department of the Interior. The staff is presently engaged in the revision of this section of the Interior Manual.

An analysis of the Federal Range Code, indicating areas of uniformity and variance as related to the Departments of Agriculture and the Interior, was prepared.

A member of the staff is chairman of the Departmental Weed Committee. A proposed chapter for the Departmental Manual on weed control was prepared.

The Technical Review Staff continued to coordinate the forest protection activities of the Department. During the past year, forest fires burned over slightly more than 600,000 acres of Interior lands. Although this is below the 10-year average annual loss of over a million acres, much is yet to be done to prevent man-caused fires and to reduce the total loss from all types of fires. Approximately 900,000 ribes bushes were destroyed in the Department's program to protect the white pine forests from blister rust. The Department has been maintaining an intensive program for the reduction of infestations and infections within the forests under its administration. During the past year effective action was taken against many pests including bark beetles in California and the southern Appalachians, needleminers in Colorado, and defoliators and mistletoe in the Southwest.

A review of the timber sale policies of the bureaus of the Department concerned with the administration of federally owned or managed forest lands continued during the year. Progress was made looking toward the improvement of timber sale procedures and timber management regulations.

The Lower Colorado River land use and trespass problem has been moved nearer a solution along the lines proposed by the Technical Review Staff, which continues to staff the program. Following a briefing of members of the Arizona and California congressional delegations on the Department's proposal, consultations are now going on with State officials.

In furtherance of its responsibility for the technical aspects of the Department's land appraisal program, the Technical Review Staff is giving attention to land appraisal practices and procedures, organization and staffing, and appraiser training. Considerable progress has been made in raising appraisal standards throughout the Department.

One of the staff of Technical Review Staff was a member of the United States delegation to the Seventh International Grasslands Congress, held in Palmerston North, New Zealand, in November 1956. This Congress was participated in by 36 nations; its purpose was the cooperative exchange of information and technical data on the development and conservation of grasslands among the various countries.

Antarctic matters continued to receive the attention of the Technical Review Staff through its representative on the Antarctic working group of the Operations Coordinating Board. The Department's primary concern is with a resources evaluation program through geologic and biologic investigations and with the processing of a large volume of aerial photography and other mapping data.

The Technical Review Staff was assigned the responsibility of acting for the Secretary on the Interagency Advisory Group which meets at the call of the Executive Director, President's Council on Youth Fitness. In order that the Department's representative may be informed at all times of programs within the bureaus which might have a bearing on the Youth Fitness objectives, an interdepartmental board was established.

Members of the Technical Review Staff have continued to serve as principals or alternate representatives of the Department on several interagency groups engaged in defense mobilization planning, to coordinate certain aspects of the Department's defense mobilization activities, and to provide staff services to the Secretariat in connection with their participation in such activities. Among the interagency groups for which Technical Review Staff provides Departmental representation are the Industry Evaluation Board and the Interagency Advisory Committee on Essential Activities and Critical Occupations. The Technical Review Staff has continued to assemble, for secretarial transmittal, the quarterly and annual reports to the Joint Committee on Defense Production, Congress of the United States, prepared by offices of the Department carrying on activities under the Defense Production Act.

On behalf of the Office of Minerals Mobilization, a staff member of Technical Review Staff coordinated the work of the Bureau of Mines and the Geological Survey in preparing commodity reports for the briefing of the Assistant Secretary for Mineral Resources, on the basis of which recommendations are made to the Office of Defense Mobilization for improving or assuring a mobilization supply. Seventeen such reports on various metals and minerals were reviewed; 14 were prepared for transmittal to the Office of Defense Mobilization by the Secretary. In addition, the Technical Review Staff coordinated the preparation of special reports on other phases of the Department's defense activities, such as the barter of surplus agricultural products for certain metals and minerals.

A staff member of the Technical Review Staff is chairman of the Technical Inter-Agency Power Group which conducts studies to evaluate the adequacy of electric power under mobilization conditions. The TIAPG includes representatives from the Office of Defense Mobilization, Departments of Defense and Commerce, and the Federal Power Commission.

The National Rural Fire Defense Committee, on which the Technical Review Staff furnishes the principal representative for the Department, has reported that State fire defense plans for 34 States and preliminary plans for all FCDA regions had been completed during the year. Attention is being given to the completion of plans for the remaining 14 States and the final plans for each of the regions.

Several staff members participated in Operation Alert 1956.

Continuing operations of the Technical Review Staff include the provision of Departmental liaison with the field committees; with the Bureau of the Budget on coordination of statistical standards, and programing of surveying and mapping; with the National

Science Foundation; and with other Federal agencies on program matters of mutual concern. The Technical Review Staff also provides central staff services in connection with the coordination and direction of the Department's participation in international activities. In addition, staff members worked on numerous special problems which were referred to the Technical Review Staff during the fiscal year.

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